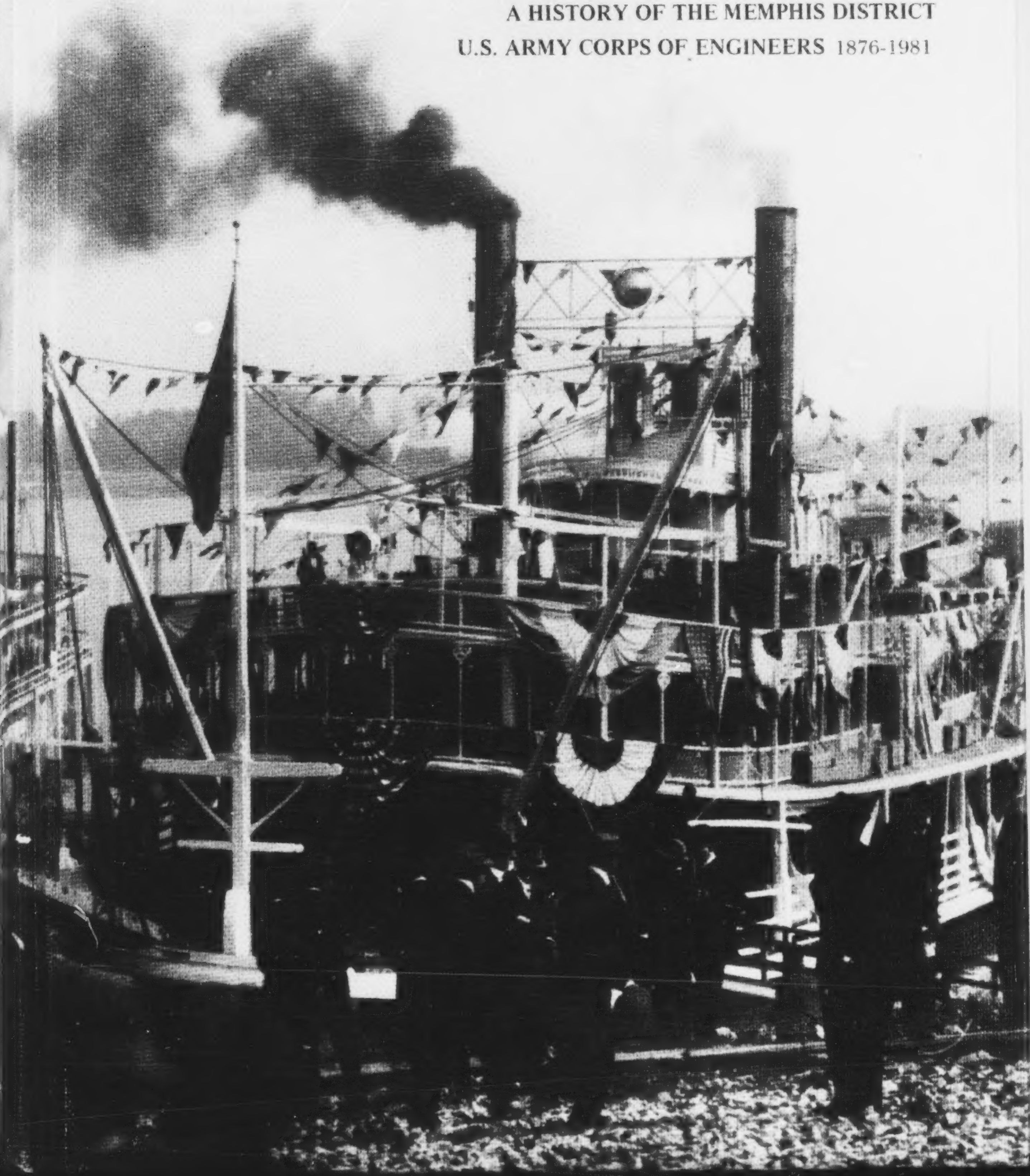
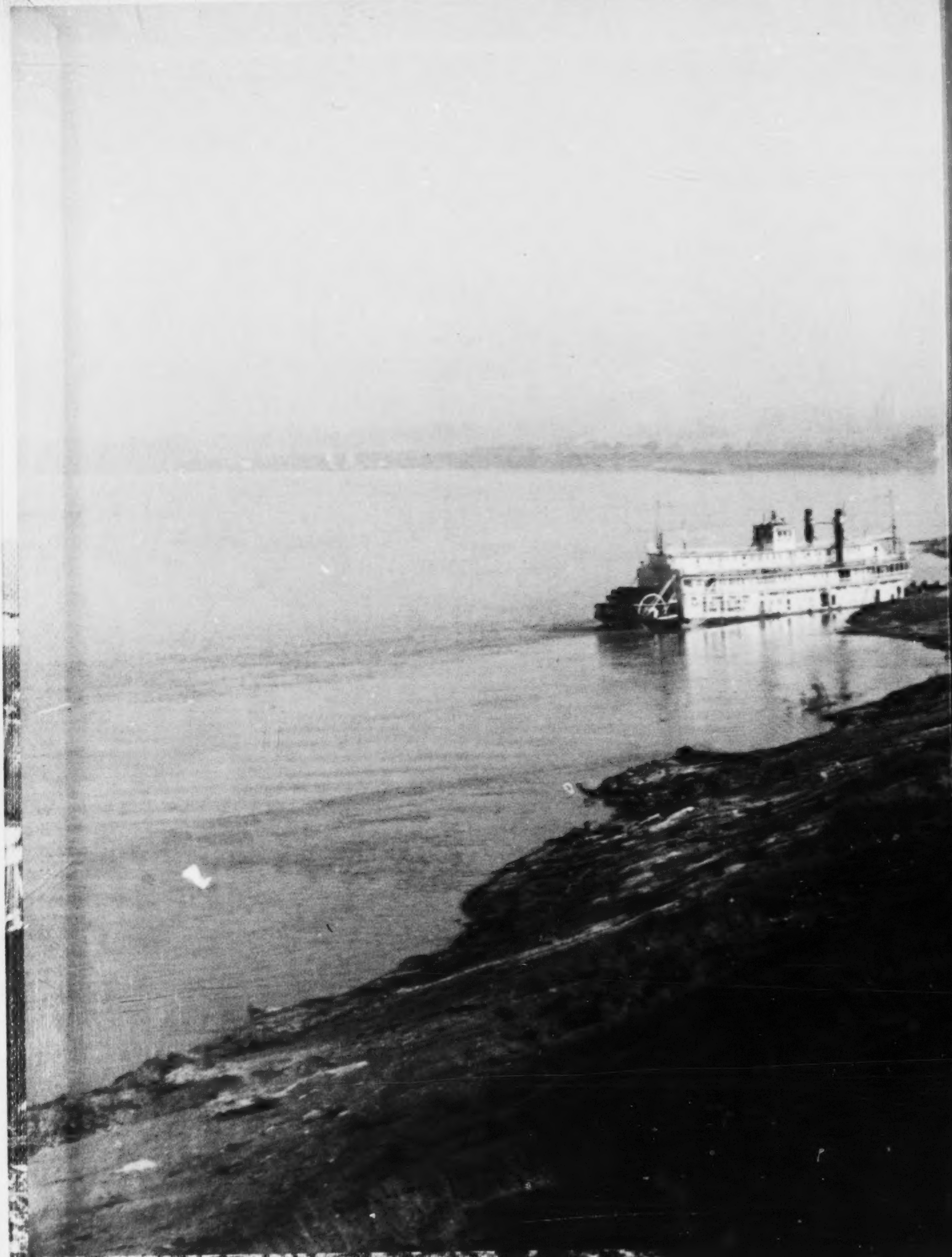
A Century on the Mississippi

A HISTORY OF THE MEMPHIS DISTRICT
U.S. ARMY CORPS OF ENGINEERS 1876-1981





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A Century on the Mississippi

A HISTORY OF THE MEMPHIS DISTRICT
U.S. ARMY CORPS OF ENGINEERS 1876-1981

By

Floyd M. Clay, Ph.D.

U.S. ARMY CORPS OF ENGINEERS
MEMPHIS DISTRICT
June 1986

DISTRICT ENGINEERS – U. S.

Capt. James B. Quinn
-1882*

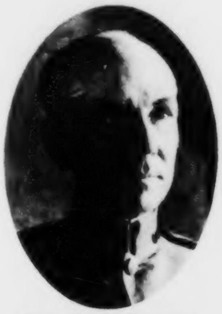
Capt. John G. D. Knight
1882-1885*

Capt. C. B. Sears
1884-1885†

Capt. Smith S. Leach
1885-1888*, 1885-1888†
1888-1890*, 1888-1890†

Capt. W. T. Rossell
1888-1888,* 1888-1888†

Maj. M. L. Walker
1908-1910


Capt. Clarke S. Smith
1910-1912

Maj. E. M. Markham
1912-1916

Lt. Col. G. P. Howell
1917-1917

Maj. John N. Hodges
1919-1923

Maj. -Lt. Col. Daniel Noce
1937-1940

Lt. Col. James D. Andrews, Jr.
1940-1941

Col. Jarvis J. Bain
1941-1943

Col. G. W. Miller, CE, AUS
1943-1945

Col. B. M. Harloe, CE
1945-1947

Col. M. L. Jacobs
1959-1962

Col. Edmund Kirby-Smith
1962-1964

Col. James A. Vivian
1965-1968

Col. Charles T. Williams
1968-1970

Col. John V. Parish, Jr.
1970-1973

NOT PICTURED: Capt. A. M. Miller, 1882-1884†; Capt. S. W. Roessler, 1890-1895; Capt. E. W. Van C. Lucas, 1902-1905; Maj. Michael J. McDonough, 1916-1917; Asst. Engr. Montgomery Gardner, 1917-1919; Capt. George J. Richards, 1923-1923.

*First District †Second District

Army Engineer District 1882–1986

Capt. Graham W. Fitch
1895-1897

Capt. Mason M. Patrick
1897-1898

Capt. E. E. Winslow
1898-1902

Capt. Wm. D. Connor
1905-1908

Capt. Gustave R. Lukesh
1908-1908

Maj. Donald H. Connolly
1923-1928

Lt. Col. F. B. Wilby
1928-1931

Maj. Brehon B. Somervell
1931-1933

Maj. W. M. Hoge
1933-1935

Lt. Col. Eugene Reybold
1935-1937

Col. E . P. Lock, Jr.
1947-1947

Col. L. H. Foote
1947-1952

Col. A. F. Clark, Jr.
1952-1954

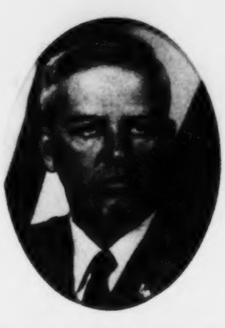
Col. E. B. Downing
1954-1957

Col. Wm. P. Jones, Jr.
1957-1959

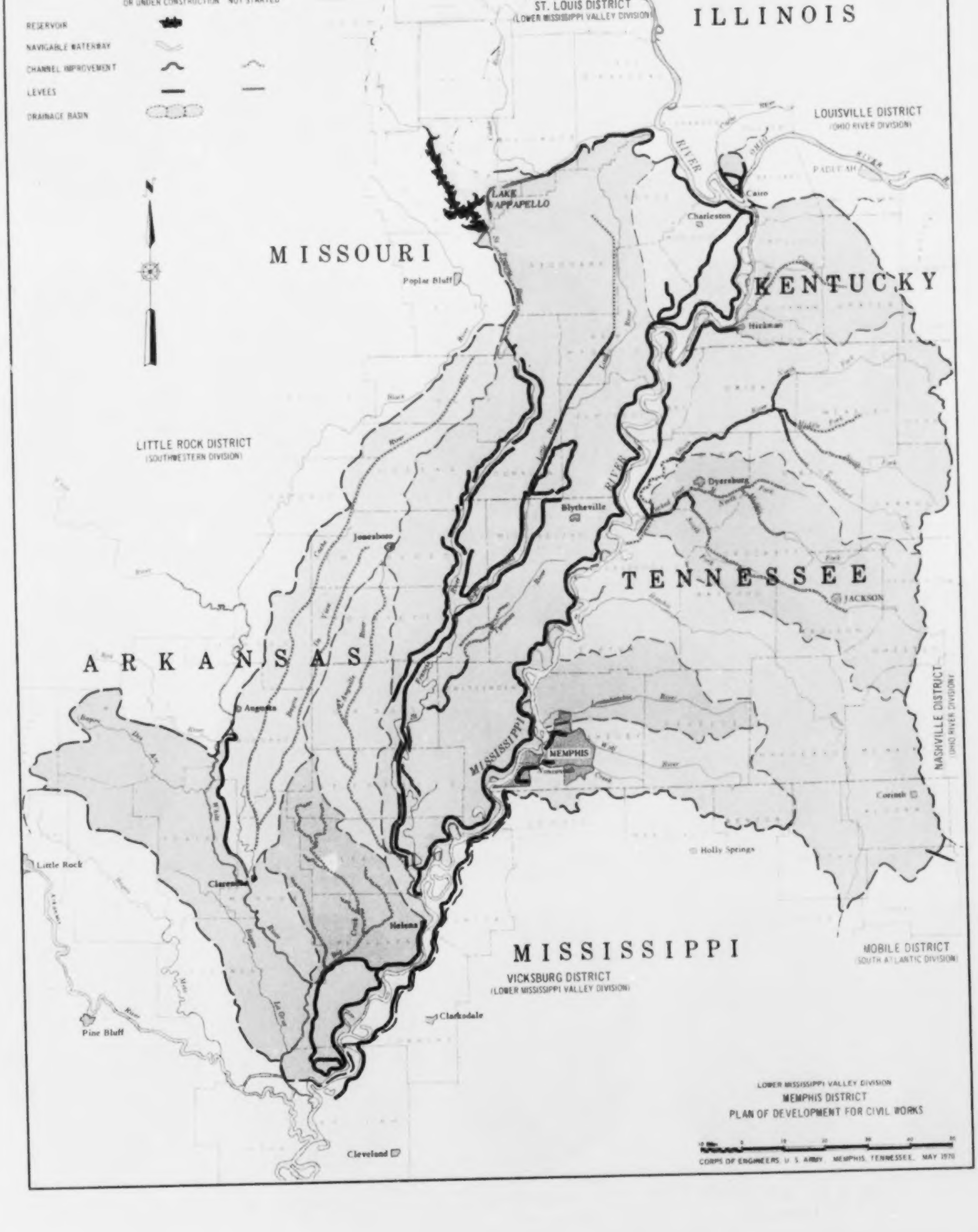
Col. A. C. Lehman
1973-

Col. R.W. LOCKRIDGE, JR.
1976-1979

Col. W.H. RENO
1979-1981


Col. J. F. HATCH, JR.
1981-1984

Col. D.F. MEANS
1984-


LEGEND
COMPLETE OR UNDER CONSTRUCTION
NOT STARTED
RESERVOIR
NAVIGABLE WATERWAY
CHANNEL IMPROVEMENT
LEVEES
DRAINAGE BASIN
N
ST. LOUIS DISTRICT
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ILLINOIS
MISSISSIPPI
RIVER
OHIO
RIVER
LOUISVILLE DISTRICT
(OHIO RIVER DIVISION)
PADUCAH
Cairo
Charleston
LAKE WAPPAPELLO
MISSOURI
Poplar Bluff
KENTUCKY
Hickman
Black
River
LITTLE ROCK DISTRICT
(SOUTHWESTERN DIVISION)
Little River
RIVER
Dyersburg
North Fork
South Fork
Middle Fork
Blytheville
Jonesboro
TENNESSEE
JACKSON
Cache
ARKANSAS
Augusta
MISSISSIPPI
MEMPHIS
Loosahatchie River
Wolf River
Nonconnah Creek
NASHVILLE DISTRICT
(OHIO RIVER DIVISION)
Corinth
Holly Springs
Little Rock
Clarendon
Helena
White River
Arkansas River
MISSISSIPPI
VICKSBURG DISTRICT
(LOWER MISSISSIPPI VALLEY DIVISION)
MOBILE DISTRICT
(SOUTH ATLANTIC DIVISION)
Clarksdale
Pine Bluff
Cleveland
LOWER MISSISSIPPI VALLEY DIVISION
MEMPHIS DISTRICT
PLAN OF DEVELOPMENT FOR CIVIL WORKS
10 Miles 0 10 20 30 40 50
CORPS OF ENGINEERS, U. S. ARMY, MEMPHIS, TENNESSEE, MAY 1970

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FOREWORD

Since 1882, the men and women of the Memphis District have performed a dedicated service toward flood control and navigation works in the Lower Mississippi Valley. In truth, their efforts have been a cornerstone in the development of the science of river engineering over many years of struggle with capricious whims of the mighty Mississippi River.

This book attempts to establish the chronology of the District's work and to show how both successes and failures well served the early engineers in the development of sound engineering techniques. Today, the Lower Mississippi River is a giant in shackles and the nation's principal waterway. As of this writing, the massive Mississippi River and Tributaries Project has proven itself, protecting the Valley through three consecutive years of flooding, including the third largest ever, the mammoth 1973 flood.

Apart from its annual flood threat, no river has played a greater part in the development and expansion of a nation than the Mississippi. Here, too, our people have been involved in a strategic role, and they have seen the fulfillment of their work. The great river has become the manageable main stem of a vast network of inland waterways, serving both waterborne commerce and pleasure craft.

And so this is their book written for those individual efforts - both past and present - which are so magnificently serving this great country of ours. It is my personal belief that the employees of the Memphis District will continue to meet the challenges of the future in the same manner that they have so admirably met those of the past.

Dale F. Means

Dale F. Means
Colonel, Corps of Engineers
Commanding

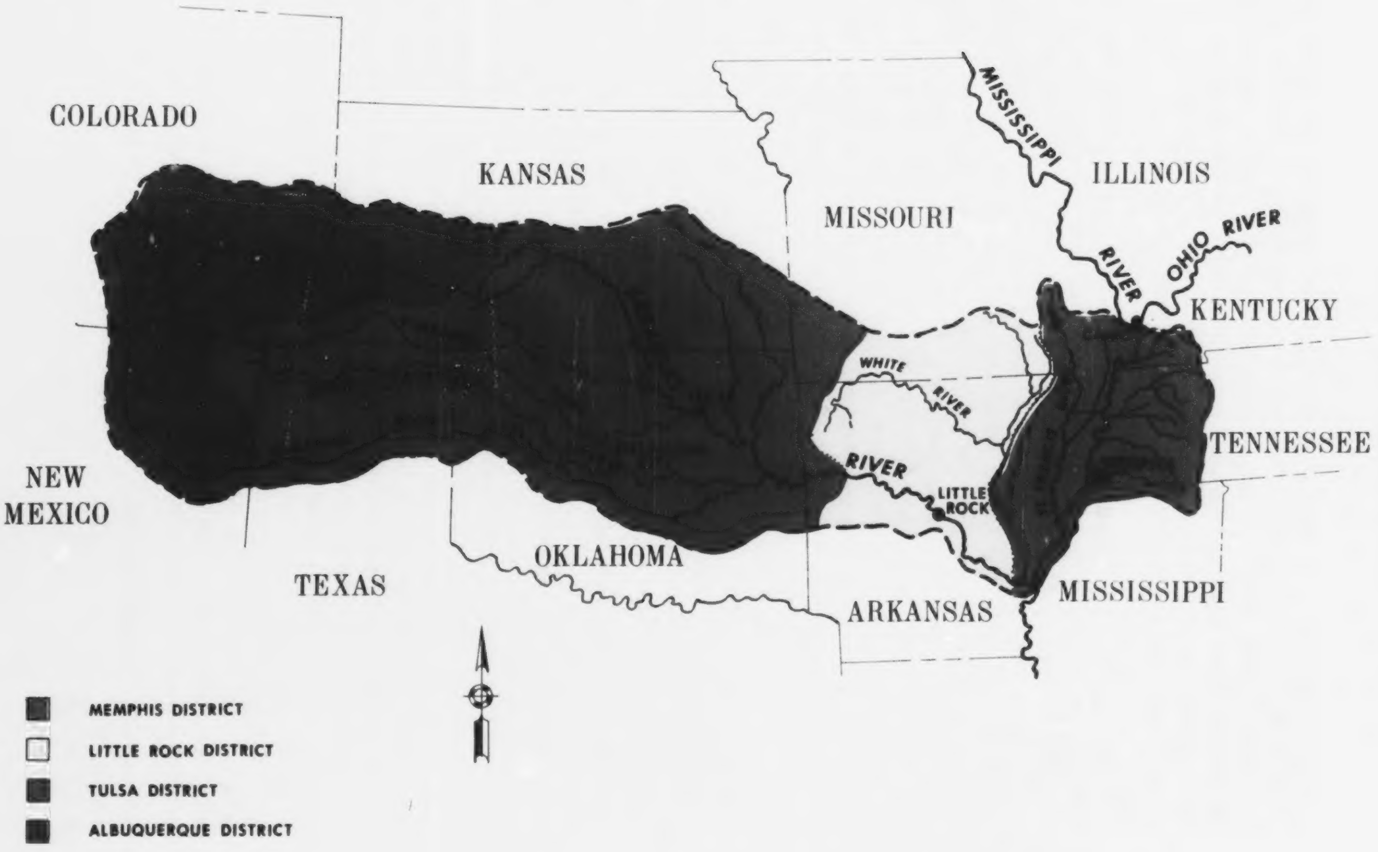
AUTHOR'S PREFACE

Too often the Corps of Engineers, like engineers in general, is fixed in the public mind as a walking slide-rule with computer instincts. The assumption is patently false, still it is difficult to write about engineering and the Mississippi River without becoming hypnotized by facts and statistics: One can't avoid the observation that the potential power in the Mississippi is about 60,000,000 horsepower, that it renders vital service to over 40% of the nation, and the discharge in the main river channel is over 2,000,000 cubic feet per second, but this author has made a conscious effort to avoid the basically statistical approach. Statistics are but part of the story of the Memphis District, and can be misleading. Samuel Clemens (Mark Twain), one of the most famous of the Mississippi River pilots, once noted that over a period of 176 years the Lower Mississippi had shortened itself some 242 miles. Interpolating the fact, he noted that the average worked out to slightly more than 1-1/3 mile per year. "Therefore," said Clemens, "any calm person, who is not blind or idiotic, can see that in the old Oolitic Silurian Period, just a million years ago, the Lower Mississippi River was upward of one million three hundred miles long, and stuck out over the Gulf of Mexico like a fishing-rod. And by the same token, any person can see that 742 years from now the Lower Mississippi will be only a mile and three-quarters long. Cairo and New Orleans will have joined their streets together and be plodding comfortably along under a single mayor and a mutual board of aldermen." In his droll manner, Clemens concluded: "There is something fascinating about science. One gets such wholesale returns of conjecture out of such trifling investment of fact."

This history, then, is not offered as a statistical exercise. The author hopes to present the story as it is, a history of men struggling against the destructive forces of nature for the betterment of man. The story was compiled through research of official records, but also through a meticulous perusal of newspapers, speeches, adversative comment, and personal interviews. The author would like to publicly express his gratitude to an army of individuals who were constantly ready to lend their assistance or cooperation as needed. A detailed listing of those individuals would be in order, but would constitute an impossible burden on the reader. Still, the author must call attention to his tireless and diligent research technician, Mr. Bobby Joe Williams, and to Public Affairs Officer, Bob Hume, who pointed the author in all the right directions and gave unflagging support and assistance beyond the call of duty. Also crucial to the enterprise was the extra burden of work willingly assumed by Ray Houston, of Photo Reproductions and his two assistants, Bonnie Keene and Elmer Holder. The satisfaction of a completed project is matched only by the gratitude for friends acquired along the way.

The author proudly presents the Memphis Engineer District, Corps of Engineers.

Floyd M. Clay, Ph.D.


COLORADO
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MISSOURI
MISSISSIPPI
ILLINOIS
RIVER
OHIO RIVER
KENTUCKY
WHITE
RIVER
RIVER
LITTLE ROCK
TENNESSEE
NEW MEXICO
OKLAHOMA
TEXAS
ARKANSAS
MISSISSIPPI
MEMPHIS DISTRICT
LITTLE ROCK DISTRICT
TULSA DISTRICT
ALBUQUERQUE DISTRICT

The old Memphis District boundaries included the four contemporary Districts here depicted. Reorganization followed Flood of 1937.

CHAPTER I

The River, the Nation and the Corps

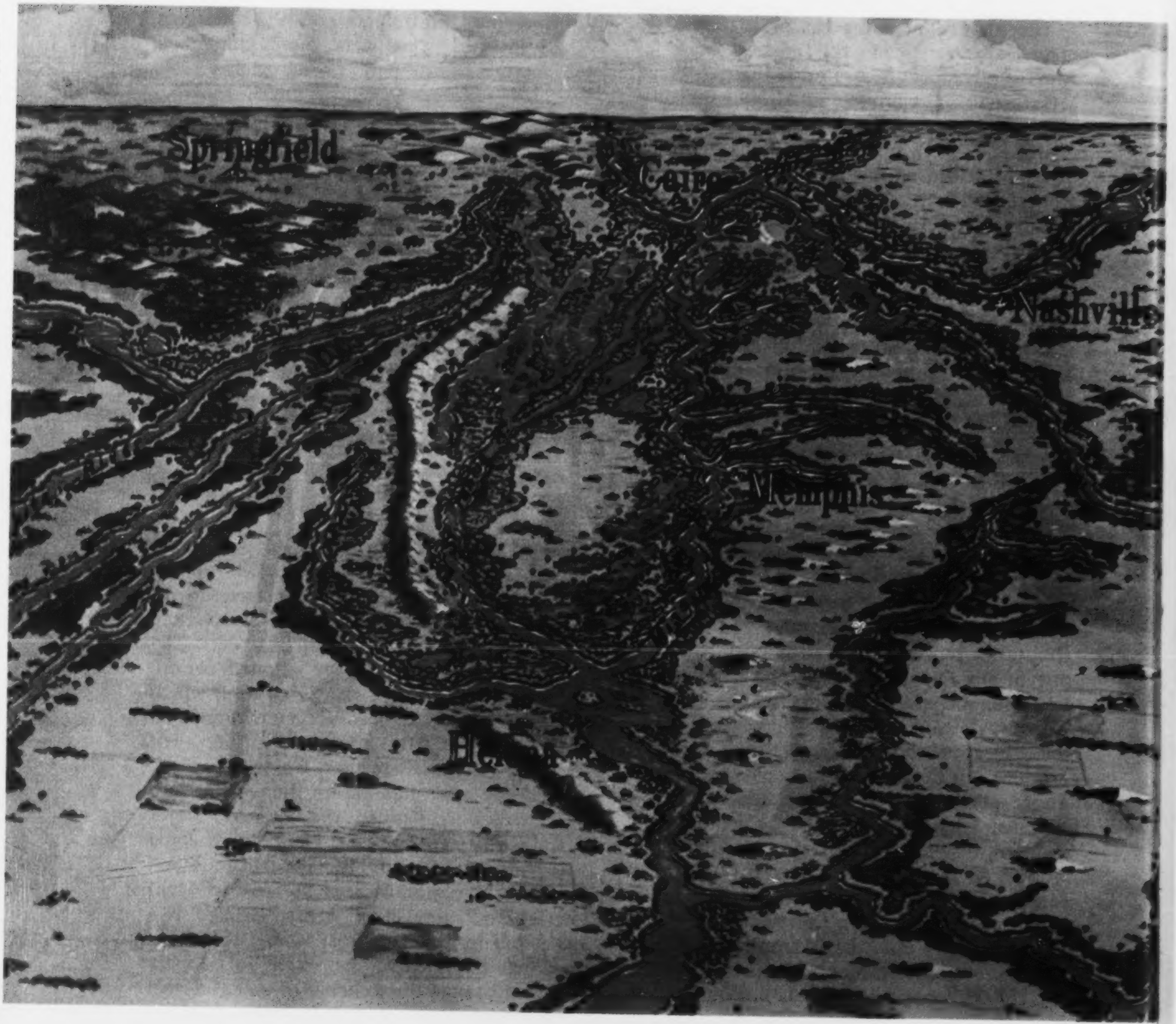
The Mississippi River has been the center piece of American folklore as well as American History. B. A. Botkin quoted an old Mississippi riverman as saying; "The Mississippi is big, rollin', tumblin', bilin' and endless . . . There ain't nobody but Uncle Sam as could afford such a river as that!"[1] Lord Roberts, known as "The Skipper's Skipper," admiringly referred to the Mississippi as . . . not to be trifled with. She demands respect and she damned well better get it, or she can be awful uppity."[2] Europeans, on the other hand, were considerably less impressed. After a trip down the Mississippi Charles Dickens described it as "an enormous ditch . . . running liquid mud . . . and obstructed everywhere by huge logs."[3]

Whatever the viewpoint, the fact is that during the colonial period, and for a long time afterward, the country could have ill afforded to be without such a river as the Mississippi. The early trappers and settlers of the Ohio and Mississippi Valleys considered the "Father of Waters"[4] as their avenue to the outside world. The Mississippi and its great tributaries represented a path both into and out of the Old Northwest. The Ohio would take the settlers and trappers into the Old Northwest, and the Mississippi represented the easiest method of transporting furs and produce out of that area to a convenient port. Those goods were rafted downriver to New Orleans, where they could be reloaded on seagoing vessels for transport anywhere in the world. As early as 1705 the first recorded cargo, a load of 15,000 bear and deer hides, had been floated down the Mississippi.[5] The River, being so essential to frontier existence, transfixed the westerner with its importance, and the backwoodsman could not understand the seeming indifference of the "Eastern Establishment" who were more concerned with matters of international importance.

It was only after the Revolution that some governmental leaders came to recognize the urgency of the river question, and then only after a major crisis. Westerners set up a howl of rage and talked of rebellion when it was thought the Jay's Treaty (1794) had bartered away navigation privileges on the Mississippi. The Spanish Governor, the Baron de Carondelet, quickly established a fort on U. S. territory at Chickasas Bluffs (Memphis), hoping to profit from Western anger, but after finding the Westerners adamant in their navigation demands he withdrew and agreed to Pinckney's Treaty of 1795, which granted the Westerners the right to navigate the Mississippi to its mouth.[6]

Simultaneously with a growing awareness of inland problems was the evolution of the agency that would eventually be charged with the maintenance of navigable rivers, the United States Army Corps of Engineers. The Corps had its genesis in the colonial period, but it was the Revolutionary war itself which created the critical need for men trained in engineering. Shortly after the outbreak of hostilities a British regular, Colonel Richard Gridley, declared himself for the colonies and was promptly awarded the rank of Major General, given a shovel and a gun, and charged with the defense of Bunker Hill.[7] When George Washington created the post of Chief Engineer of the Grand Army, Gridley was appointed to that new post where, unlike his previous experience, he was no longer expected to man the trenches as well as design

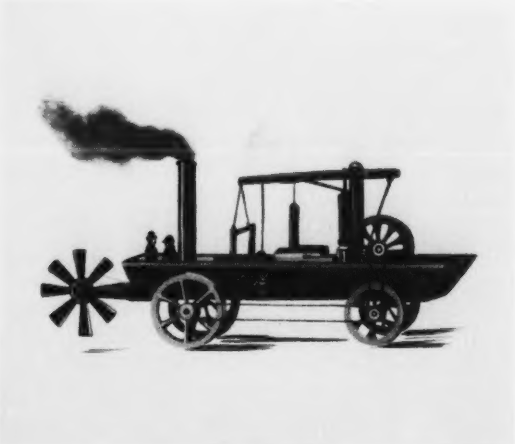
This mid-19th century artist's concept of the Mississippi valley is interesting in its portrayal of both fact and misconception. The ridge at left center of the picture is Crowley's Ridge.


Springfield
Cairo
Nashville
Memphis

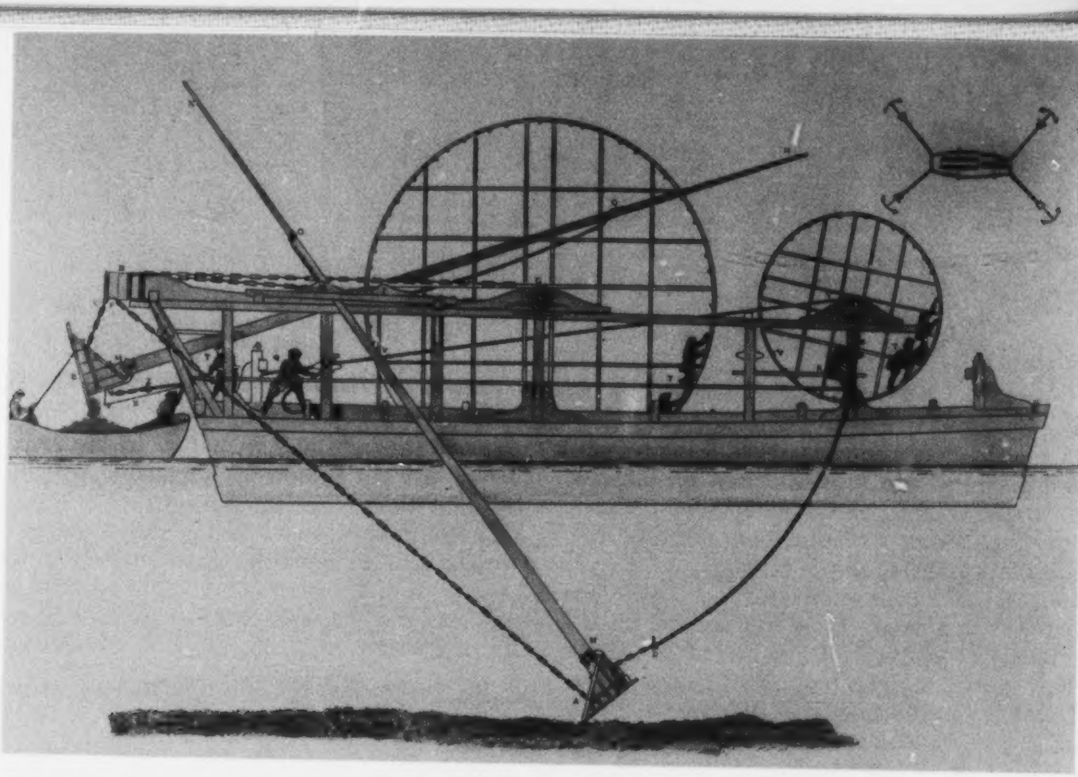
them. His new duties revolved around design and planning, and thus was born the concept of a special engineering agency for the army. It was a tenous concept at best, and Gridley's successor resigned when Congress refused to authorize a Corps of Engineers. It was not until 1779 that Congress did consent to the creation of a "Corps of Engineers," and it was with the appointment of a Frenchman, Louis LeBeque du Portail, that the Corps found itself on solid footing. The work of du Portail in the crucial Seige of Yorktown convinced Congress that the nation needed a stable source of engineers, and Congress authorized du Portail to design a plan for a school of military engineers. After the successful conclusion of the Revolution du Portail returned to France to assume important duties in his native country. His successor, Lieutenant Stephen Rochefontaine, implemented du Portail's scheme and established the Engineer school at West Point, in 1795.[8] West Point cannot be underestimated in its historical role in the development of our nation. Until 1824 it was the nation's *only* school of engineering. Apart from the obvious military requirements, West Point provided the nation with a body of trained, disciplined and dedicated men who could treat with domestic and economic problems. No agency except the government was large enough to undertake national improvements, and no institution except West Point was training men with the technical skills and attitudes to cope with the problems. The original school at West Point was destroyed by fire in 1796, but was rebuilt immediately, graduating its first class in 1802.[9] Since that time this great school has provided the technical capabilities for national survival and economic growth.

The early years of the Republic were years characterized by unanswered questions rather than solutions. The very nature of the Presidency was not thoroughly understood. Small wonder, then, that the question of Internal Improvements was not easily settled. Westerners in particular were expected to cope with their own problems, and aside from Indians, the biggest problem was that of transportation.

By the time of the war of 1812 the entire length of the Mississippi was in American possession, and traffic on the river was heavy although essentially one-way. Rafts, flatboats and keelboats floated to the Mississippi via its various tributaries, then drifted on to New Orleans. There the goods were unloaded, the rafts disassembled and sold, and the backwoodsmen made their way back home through some overland route. The most famous of these return routes was the Natchez Trace.



Shortly after James Watt developed a practical steam engine, this amphibian concept was devised as a river workboat. Both the wheels and the paddle-wheel were belt driven. Sketch dates to 1795.



A drawing of an early concept in "machine" dredging. Pre-dating the era of the Steam Engine, this machine was designed to dredge the harbor at the Port of Tulon, France, in the 18th century. Note that the scoops were powered by men in squirrel cages.

The Mississippi River was always manageable to these flatbottomed, slow moving conveyances, thus any thought of channel deepening or dredging was confined to the mouth of the river, to assure that deep water vessels could always make it at least as far as New Orleans. As early as 1726 private interests had dragged harrows across the mud and sand bars at the mouth of the passes, where the Mississippi dumps its burden into the Gulf Stream. The concept, one which is still used in river work today, was that any loosened sediment would be carried out to sea by the scouring action of the current. At times other methods of loosening the sediment have been tried; dynamite laden torpedoes, buried some ten to twenty feet below the surface of the sand, were exploded; large quantities of powder in tin canisters were placed directly on the offending reefs and exploded. No method worked any better than the primitive harrow, however. At least not until post Civil War technology was applied.[10]

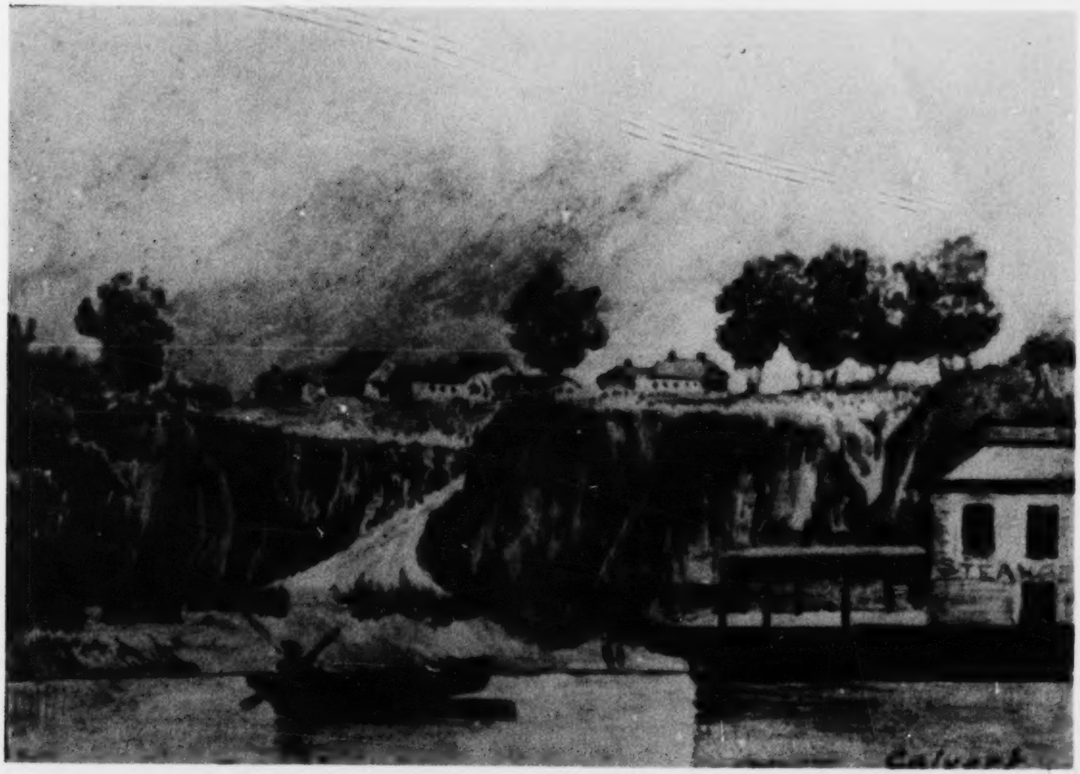
Contributing to the usefulness and stabilization of the lower channel, though not designed for that purpose, were the private levees that were built to protect the great plantations below Baton Rouge. Since the river banks were barely above the water in normal flow, the lands were constantly flooded at high water. The obvious solution was to throw up and maintain private levees.

The first levee to be constructed on the Mississippi was that designed by Sieur de la Tour, the engineer for Sieur Jean de Bienville, founder of New Orleans. After layout of what is now called the Vieux Carre section, la Tour ordered the construction of a levee to protect the settlement. The first levee was only about three feet high, but it was the beginning of a network that would one day evolve into a small, man-made, mountain range of levees. By 1735 early settlers had protected their property on both sides of the river from New Orleans northward for about thirty miles; by 1802 the levees extended as far as Baton Rouge, the first high ground above the mouth of the passes, and by 1849 the levees were extended up the west bank of the River almost as far as the Arkansas River mouth.[11]

At first, of course, there were no standards. Each owner built a levee to his own concept of protection. Even so, as these levees were connected, a "system" of levees had come into being, with the inevitable result that the River could run higher before causing flooding.[1][2]

In the meantime the Mississippi River was developing a lore and romance second to none in American History. The men who floated down the river were by self-definition the meanest, roughest and toughest men anywhere. These character traits blended well with the Mississippi River. The height of Romanticism however, and the real need for improvement of the River, awaited the coming of the steamboat.

The first steamboat to travel the Mississippi had the same name as its destination, New Orleans. The *New Orleans* had been built at Pittsburgh, at the direction of Nicholas J. Roosevelt. Costing $38,000, the *New Orleans* was not really suitable for travel on Western waters; it sat deep in the water, was about 148 feet long, and was equipped with two masts to carry sail despite the fact that it was



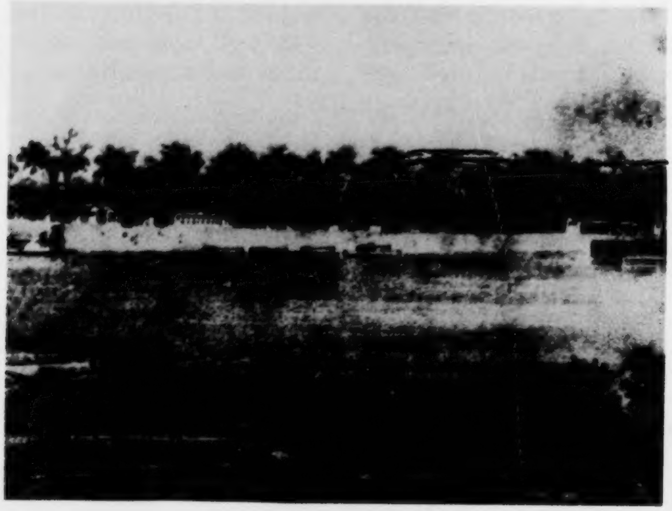
Memphis, in 1832, was somewhat larger than depicted in this 1832 painting.

powered by a large steam engine. With a crew of thirteen it was more nearly like the ocean-going vessels that could also venture up river when conditions were right.[13]

Exuding the confidence that would characterize his great-grand nephew, Theodore ("Teddy") Roosevelt, Nicholas brought his wife and dog along on that first historic voyage.[14] He had prepared well for the trip, having talked with rivermen, charted the waters, and having arranged for supplies of firewood and coal to be located at strategic points.

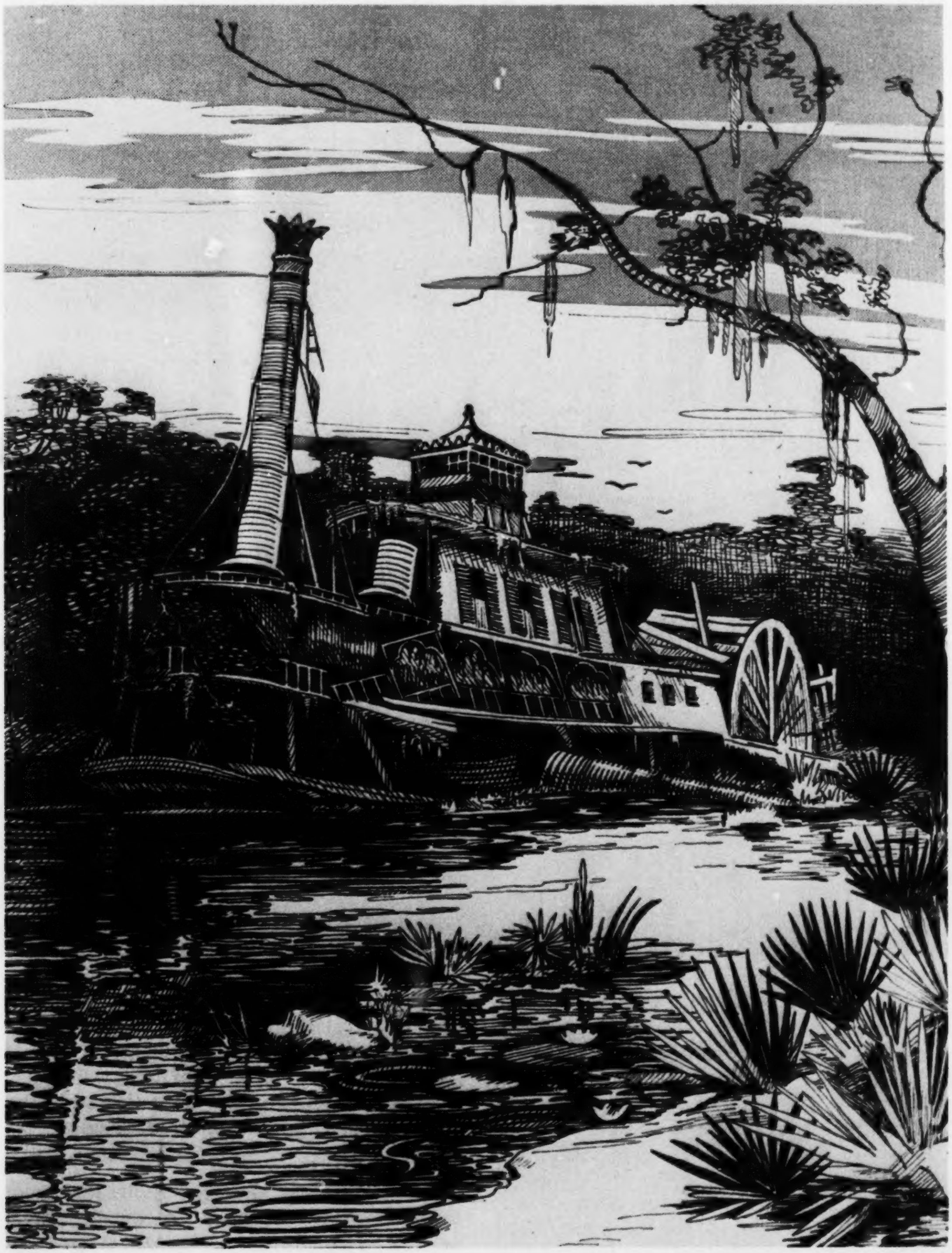
The voyage proved to be unusually adventurous as well as historic, for it was during the course of the trip that the famous New Madrid earthquake occurred. Plying the waters of the Mississippi just below Cairo, the crew and passengers were frightened by massive earth tremors, great waterlevel fluctuations, and land sloughing. The surrounding land heaved in such massive dislocations that for a few hours afterward the Mississippi River reversed its course to fill in newly created basins. As the *New Orleans* approached New Madrid, some residents called and pleaded with Captain Roosevelt for passage, but most were so frightened by the new steam contraption, with its belching plumes of smoke and fire, that they preferred to take their chances with nature.[15] As it turned out the successful voyage of the *New Orleans* would have greater impact on the vicinity than did the earthquake. Even the thoroughly shaken community of New Madrid would rebuild in an era of prosperity generated by the coming of the steamboat. Even as the town rebuilt the lost business section, placing the new buildings on rollers so that they might be moved away from the bluff as it continued to slough off,[16] up-river commerce was arriving.

The arrival of the *New Orleans* at its destination was cause for a public celebration and fireworks display, including a full cannon salute. The voyage had taken three and a half months from Pittsburg, and the upriver rate would be proportionately less (3mph), but the important fact was that the *New Orleans* could and would engage in upriver commerce.[17]

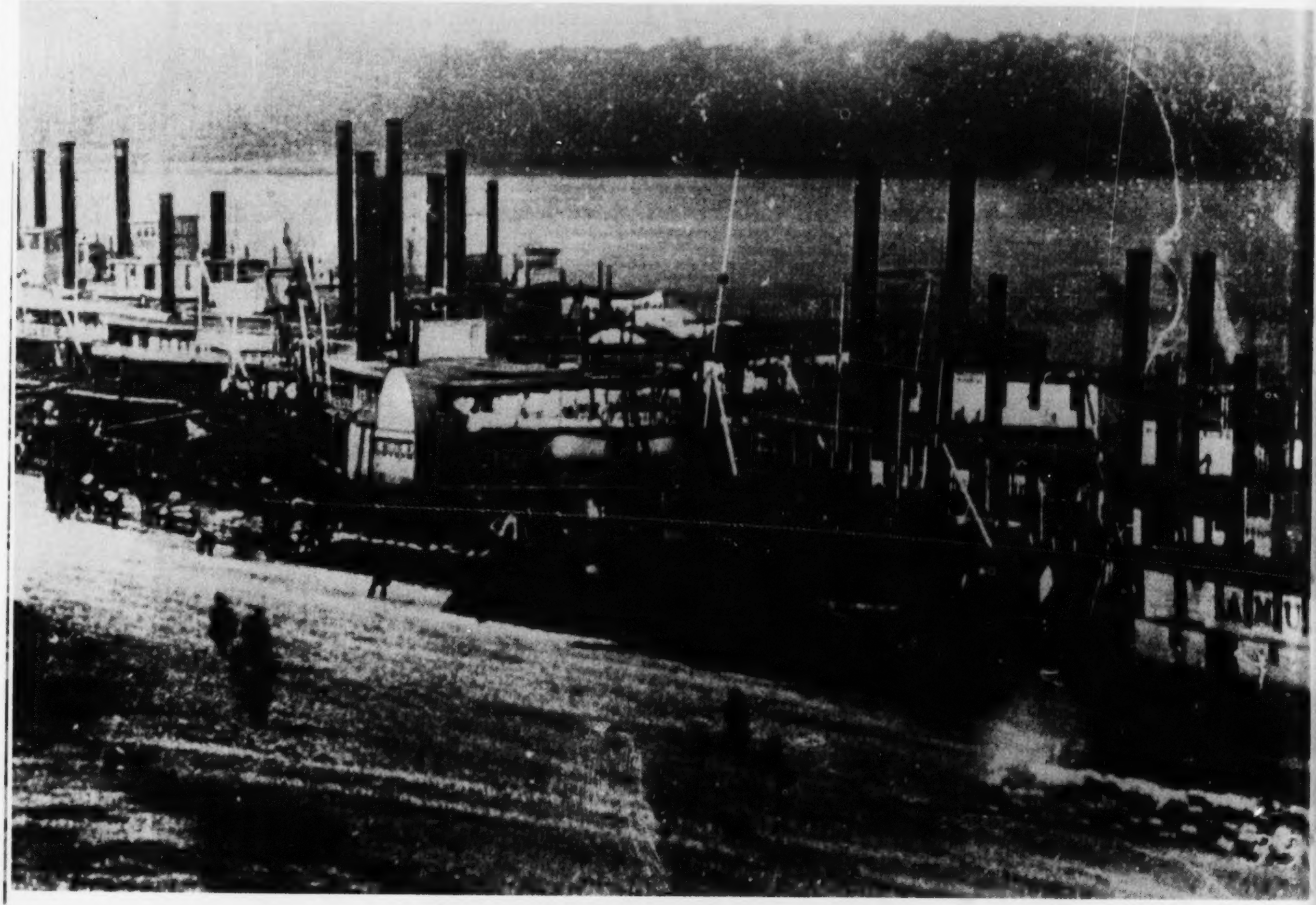


Cairo, Illinois, in 1841.

The romantic era of the Steamboat brought with it the economic floodtide of the river, and with the ever increasing economic importance of the river came greater demands for governmental aid in navigation. No longer content to have only New Orleans open to the Gulf, shipping interests, and the interests of mid-America, demanded that the river be



The romanticism of a decaying era is depicted in this pencil sketch. It was not too unusual for a ship to become mired permanently in the attempt to navigate a shallow chute. As the river changed courses many of these land-bound relics became a part of the pastoral scene.



The St. Louis Levee in the days before the Civil War.

made navigable to great inland ports. On February 15, 1819, responding to the "Era of Good Feeling" following the successful conclusion of the War of 1812, Congress approved a law calling for a survey of the Mississippi River and its tributaries. The unenlightened state of that Congress may be adjudged by the appropriation, however, which was set at a meager $6,500.[18] The survey was to be undertaken by the Corps of Engineers.[19]

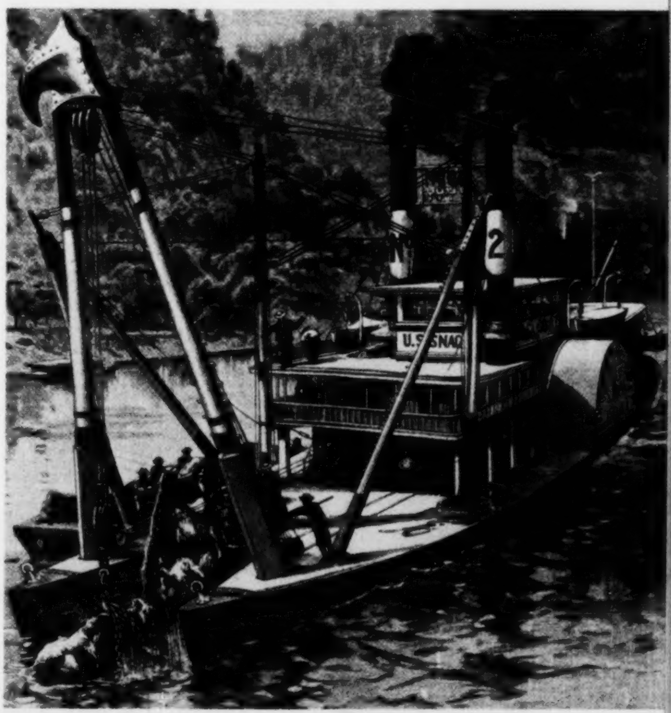
In 1824 Congress enacted the first of many River and Harbor Bills. That particular bill simply authorized the President to expend $75,000 for the removal of trees which had lodged themselves in the navigation stream of the Ohio River and the lower Mississippi.[20]

Other than the river bed itself, the major obstructions to navigation of the river were mostly in the forms of "snags, sawyers, or planters." A "snag" was a tree which had broken loose from the bank and floated into the navigation line of the stream. There the base of the tree would settle to the bottom of the channel and the trunk would thus become a lethal spike capable of impaling an unwary ship. Steamboats were often shafted through all three upper decks as well as their hull. A "sawyer," on the other hand was similarly fixed to the bottom of the channel, but in a less rigid stance. The "sawyer" was so called because it bobbed up and down with the current or waves, thus being more capricious than the fixed snag. A "planter" was usually a tree that remained as an obstacle when the river was cutting a new chute. The process of clearing all these obstacles from the thalweg (the deepest channel of the river) was called snagging. Snagging was the principal concern among those who thought of river improvement, and appropriations usually were exhausted long before the year had elapsed.

The task of snagging fell to the Corps of Engineers as the only readily available agency of government capable of dealing with the problem.

It was not long before civic interests within the river towns were demanding more of government. In addition to the demands for Federal aid to improve navigation and harbor facilities, landowners were beginning to demand that the government take a larger concern with flood control. This request was largely ignored, however, considering the historic and prevalent attitude that flood protection of private property was the responsibility of the property owner.

Through the ingenuity of Henry Shreve, one of the pioneer steamboat captains of the Mississippi, snagging was elevated from a jerk-and-pull operation to a science. By 1820, every steamboat on western waters followed a design innovated by Captain Shreve; the engine had been put on top of the deck, instead of under it, and the hull was little more than a shallow draft platform. Since western waters, particularly the minor tributaries, ran shallow, the design of shallow-draft vessels became a science in itself.



U. S. Snag Boat No. 2 is a slightly enlarged version of Capt. Shreve's original snag boat, the Heliopolis. Harper's Weekly, 1889.

Some boats would be so constructed as to draw less than a foot of water.[21] But no matter how lightly the boat sat in the water, the snags and sawyers remained as a major shipping menace. Shreve attacked that problem with similar ingenuity. The boat which he designed for the specific task of snagging was a two-hulled affair that could smash into and straddle a snag. If the snag was not jarred loose by the impact, it could then be raised by means of a hoist operating on an "A" frame. Once raised, the snag could be sawed into harmless pieces and allowed to drift away. The *Heliopolis* was a weird looking craft, but so successful in its maiden effort that it set the pattern for all time. For its initial test Captain Shreve attacked the most congested and troublesome stretch of the Lower Mississippi, the Plum Point stretch. Before a group of awed rivermen and other onlookers the *Heliopolis* cleared a forest of snags in the space of a few hours.[22] Shreve went on to fantastic successes in other troubled areas. It was he who solved the seemingly impossible problem of a 160 mile log jam on the Red River, and it was for him that the grateful citizens named their community Shreveport.[23] The clearing of the Mississippi could not be a private enterprise, however, and, in 1824, Shreve offered his snagboat design to the Federal Government.[24] When Congress made its first appropriation for construction of snagboats, it was Captain Shreve who was appointed to superintend the construction of those boats. The Corps of Engineers, utilizing the Shreve-type snagboats, opened western waters as never before, establishing river highways into the interior and creating conditions favorable to settlement of new lands. The snag problem can never be eliminated, of course, but Shreve had proven that, with proper equipment and appropriations, it could be greatly reduced. Rivermen of the early 1800's did not expect their craft to have a long life even under the most favorable conditions. Snags, sandbars and boiler explosions generally contrived to keep a vessel from becoming more than a few years old. Fortunately for river commerce, profits were such that a craft could pay for itself in about twenty weeks and a shipowner could absorb the loss.[25]

Some western steamboats reached pinnacles of luxurious appointments not matched by hotels of the period. These floating hotels popularized river travel and focused public interest on river improvement. Lurid and sensationalized stories of boiler explosions and other river tragedies only heightened public interest in steamboating, and reckless and/or daring river captains ignored all safety devices in order to set new records.

One type of record – about which no one would argue – was the increasing rate of river tonnage. As early as 1834, New Orleans recorded 2,300 steamboat landings,[26] and within only twenty years after Shreve had made his presence felt there was more river traffic on western waters than on the Great Lakes and on the Atlantic Coast combined.[27] The daring river captains became the most respected and admired men in the west. But being a succesful river captain required more of a man than simple bravery, or even good eyesight and good judgment. Mark Twain, who was himself an excellent Mississippi River pilot, said that a pilot had to know the river with such "absolute certainty" that he could steer by reading the picture *in his head* rather than the one before his eyes.[28]

CITY GUN SHOP

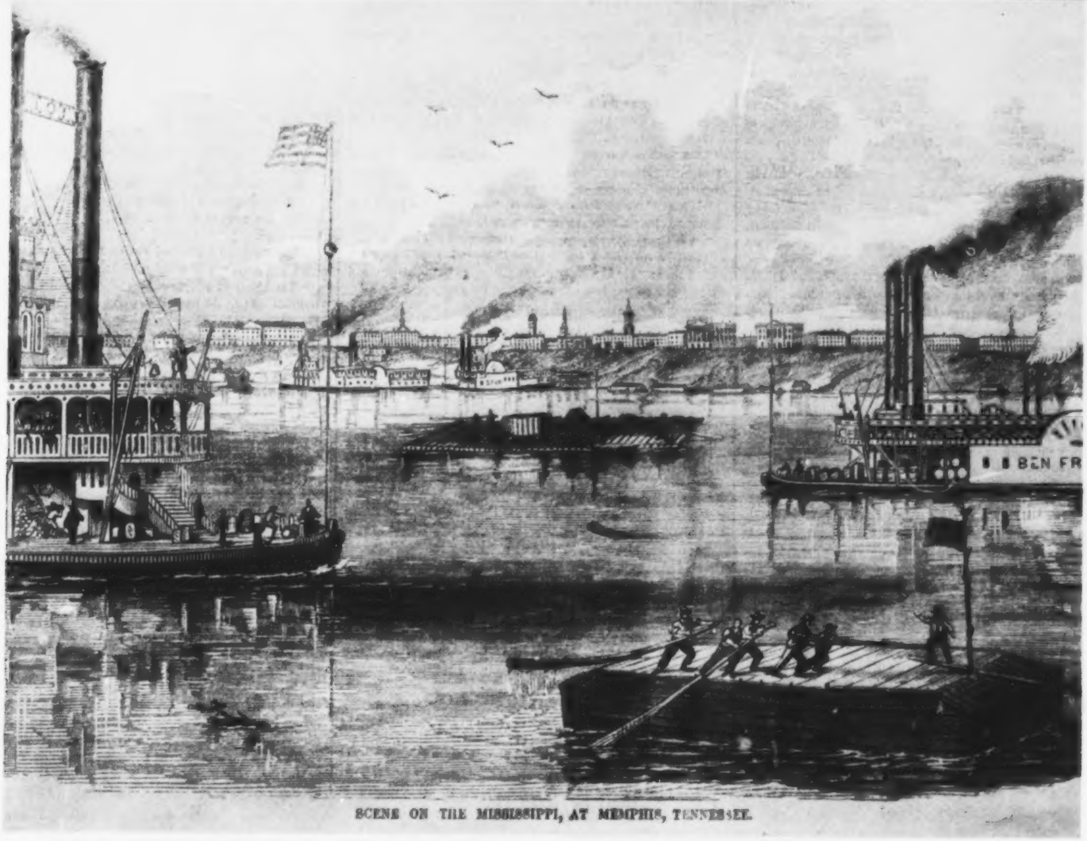
Cairo, Illinois, featuring its new boardwalk in 1865. Commercial Avenue. From the Cairo Collection, Cairo, Ill. Public Library.

A cautious and conservative pilot could reduce the probability of disaster, but never eliminate it. Snags, sawyers, boils (whirlpools exclusive to the Mississippi River), fog and defective boilers all took their toll. One passenger swore that a voyage on the Mississippi was "more dangerous than a passage across the ocean. Not merely from the United States to Europe, but from Europe to China."[29] At the same time he noted, however, that the circulation of steamboats was as necessary to the West as that of "blood to the Human system."[30]

Reflecting increasing governmental awareness of river problems, Congress in 1826 authorized the appointment of Captain Shreve as Superintendent of Improvement on the Mississippi and Ohio Rivers, a post Shreve held until 1841.[31] The 1840's and 50's were also notable for the frequency of the so-called River Conventions. The conventions were held in the cities that would most benefit from increased river commerce, with Memphis as the apparent focal point. These Conventions brought together all of those who were most vocal in their river demands, both navigation demands and flood control demands. In an effort to attract the maximum amount of attention to the Convention the promoters strived to attract national figures as featured speakers or officers. Unfortunately much of the oratory was negative, denouncing the Eastern Establishment/Atlantic States for dictating river policy in the interior.[32] However, some serious re-thinking was occurring on the national level. In 1844 President Tyler told Congress that the Mississippi River was a unique highway serving the commerce of the whole country, and it would be as incorrect to let the bordering states bear the burden of its improvement as it would be to let them control commerce on the River. The United States, he said, must be charged with the improvement of the River "for the benefit of all."[33] At one of the most historic River Conventions, held in Memphis in 1845, John C. Calhoun demanded that the Mississippi be given as much attention as any of the other

In 1865 Cairo stood on the threshold of a New Era of River prosperity.

DRY GOODS CLOTHING
CITY DRUG STORE
HARDWARE GLASSWARE & QUEENSWARE
FURNITUR
DRY GOODS BOOTS & SHOES


B BEN FR
SCENE ON THE MISSISSIPPI, AT MEMPHIS, TENNESSEE.

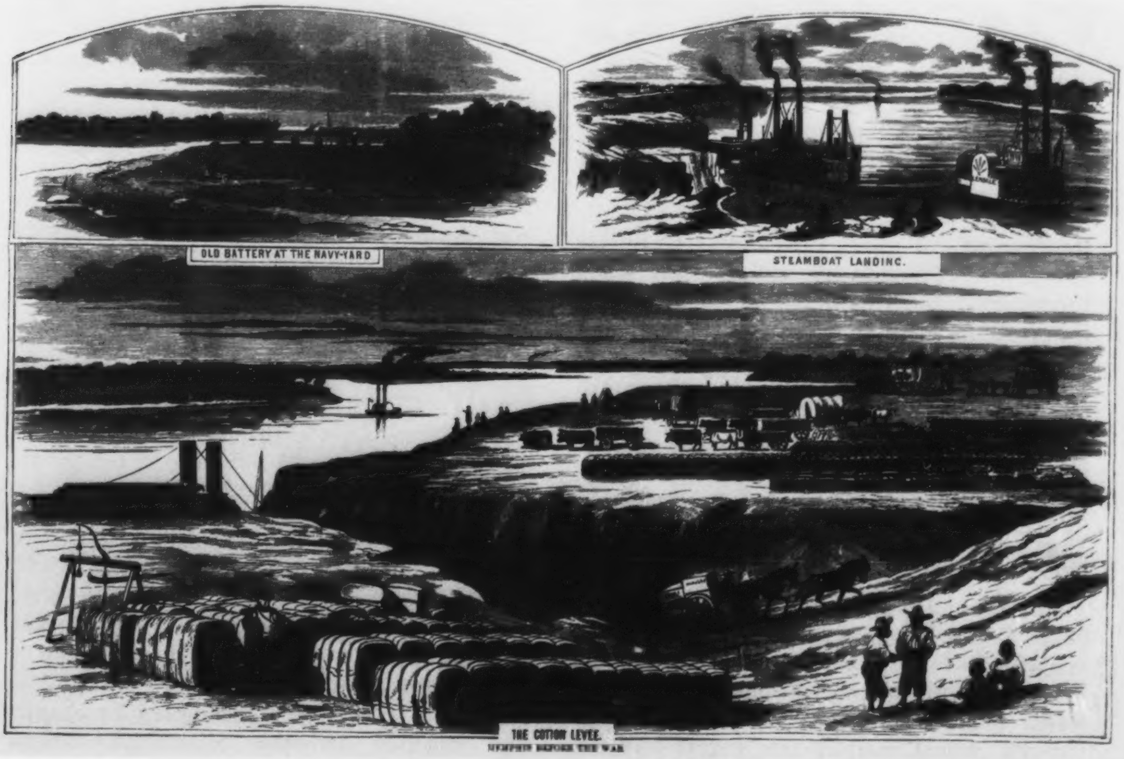
Pre-Civil War pencil sketch of various crafts on the River at Memphis. Circa 1850.

major waterways and ports of the nation.[34] Periodic appropriations for snagging were no longer considered adequate, and there was a growing demand for dredging to maintain the channels during low-water seasons. Also, the conventions took the lead in stressing a need for a levee system, designed by the Corps of Engineers and constructed under federal supervision and with federal aid. Other conventions, at Chicago, Cincinnati, and St. Louis, stressed the fact that the total river problem was one of "high national dignity," and should not be left to local interests.[35]

While there was some cooperation and coordination among the states and counties bordering the River, the expense of upgrading poorer levees, and building levees where the frontage was not in use, was a major problem. This was met head-on in 1850 with the Swamp Lands Act. The Swamp Lands Act transferred ownership of lowlands along the river to the various states. The idea was as old as the French colony of Louisiana. During that early period, the Crown sold off the lowlands and used the proceeds to assist the government in constructing levees. Now, with the Swamp Lands Act, the States were given the land so that they could sell it and use proceeds to construct levees.[36] With the new availability of funds, Levee Boards were set up in the various counties, and the Corps of Engineers provided technical guidance for levee construction. It was during this period that the shape of the levees began to change, with less slope on the river side but with increasing slope support on the backside of the levee.

Under the Swamp Lands Act impressive amounts of land were conveyed to the area states. While Tennessee and Kentucky, on relatively high ground, received no land under the Swamp Act, Missouri was given 3,347,000 acres, Arkansas 7,686,000 acres, and Mississippi received 3,290,000 acres.[37] Without the funds made available through the provisions of the Swamp Act a levee system would have been long delayed, if not totally suspended, in the 19th century. It was these same funds which also made it possible to begin a minor levee construction program in the St. Francis basin. During the period 1851-1858 small (3 ft.) levees were constructed in an intermittent line on the west bank of the River, from the Commerce Hills to near the mouth of the St. Francis River. However, the height deficiency of these levees caused them to be virtually wiped out in the flood of 1859. Short lived as was this "system," it was the highest stage of Lower Mississippi Levee development to that time. Its usefulness during the lower stages demonstrated how effective a better levee system would be.[38]

Some of the Harper's Weekly sketched scenes of Memphis on the eve of the Civil War. The upper right is a view looking downstream, while the lower panel is a view looking upstream past the bluffs to old Hen and Chicken isle.


OLD BATTERY AT THE NAVY-YARD
STEAMBOAT LANDING.
THE COTTON LEVEE.
MEMPHIS BEFORE THE WAR

"Sultana," vastly overloaded with Northern troops going home after the end of the Civil War. This picture was believed taken at Helena. The boat sunk before it reached Memphis, with great loss of life.

THE HISTORIC SURVEYS

During the same period, Congress authorized two historic surveys. In 1850, pursuant to an Act of Congress, the Secretary of War directed Mr. Charles Ellet, Jr., to make a complete survey of the Ohio and Mississippi River, with a view toward a master plan for flood prevention and navigation. Ellet's report, contained in Committee Document No. 5, 70th Congress, 1st Session, was the most complete report to that date, but unfortunately was flawed by a suggestion that flood waters could be stored in a reservoir system, a geographical impracticality if not an impossibility.

At the same time, Captain A. A. Humphreys of the Corps of Engineers initiated a separate report as part of a topographic and hydrographic survey of the Delta of the Mississippi. In 1857, Lieutenant Henry L. Abbot, C. E., was detailed as an assistant to Humphreys, and when the report was completed, in 1861, it was commonly known as either the Delta Survey or the Humphreys and Abbot Survey. The survey, although temporarily buried in the avalanche of the Civil War, was to have a tremendous impact on river and flood planning.

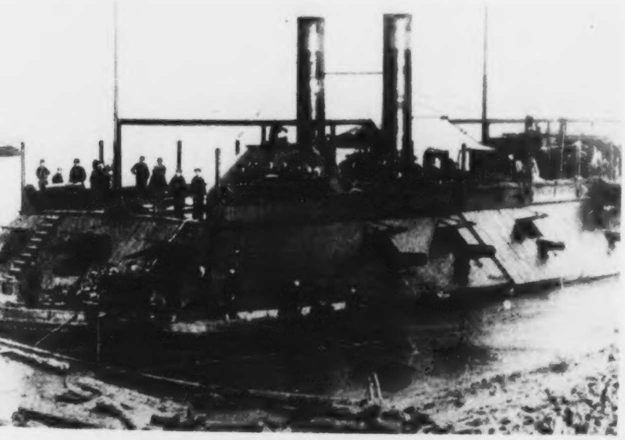
Abbot and Humphreys suggested that floods could be minimized, and the channel deepened, by some straightening of the Mississippi, by cutting through some of the major loops and bends in the river. The cut-offs would permit the waters to flow more freely toward the Gulf, high waters would be reduced, and the increased velocity of the water would scour the channel more effectively. Additionally, they strongly recommended a complete levee system and rejected the concept of a reservoir system or a parallel tributary system as an answer to flooding. The Delta Report, as it was called, despite a few errors, was an "important step forward" in the development of river engineering in the United States.[39]

As always, floods acted as catalysts for public action and concern, and the flood of 1858 might have led to immediate and substantial federal attention to both navigation and flood control had it not been for the national trauma of events leading to the Civil War. Abolitionist activity, Southern demands for a slavery guarantee, the Lincoln-Douglas Debates, "Bleeding Kansas," the Dred Scott Decision, John Brown's raid at Harpers Ferry, the failure of the Fugitive Slave Law, and excitement over the forthcoming elections all seemed to guarantee what Senator William H. Seward called an "Irrepressible Conflict." Certainly these were heart-thumping issues that overrode normal concerns.

The Civil War totally shelved the river problem. Not only did both North and South abandon their efforts to improve the River, each contributed heavily to the destruction of what few improvements had been effected. Levees were cut for military egress, and Ulysses S. Grant even attempted to change the channel of the Mississippi before

Vicksburg. At the end of the War, the River and its tributaries were in far worse state than any time before 1820. President Andrew Johnson, in his annual message to Congress in 1866, noted the urgency of the matter,[40] but both personal and political problems with Congress assured that Congress would disregard any instructions coming from his turbulent administration.

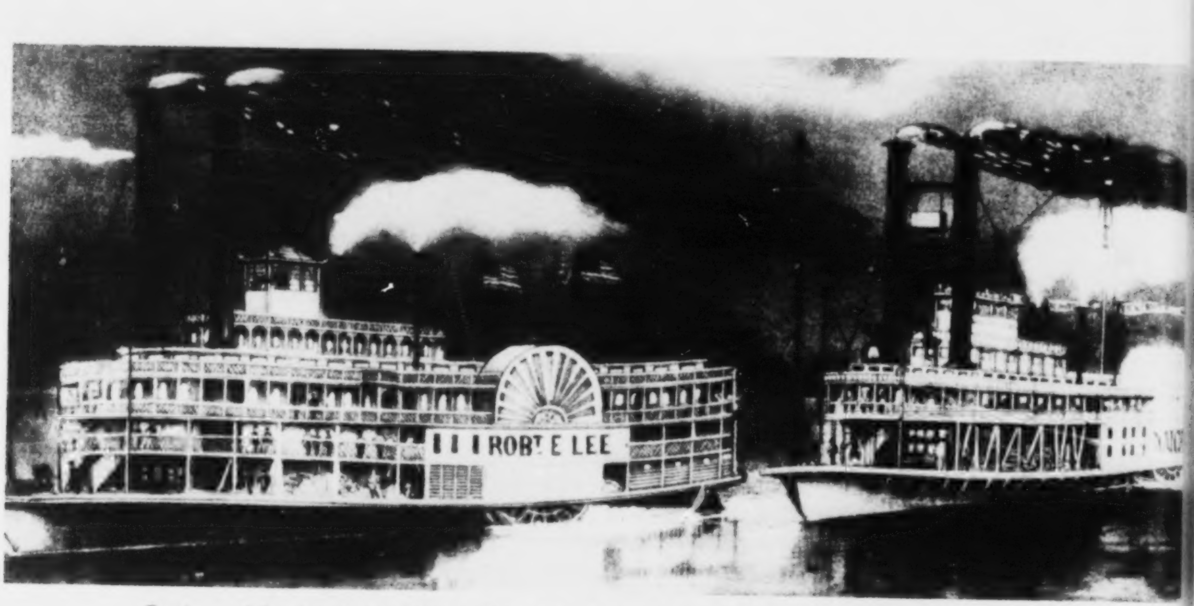
By 1871, "Radical Reconstruction" was on the wane. A sign of returning normality was evident in that year when Congress directed that the Corps of Engineers establish gages at specific points on the Mississippi and certain tributaries. Gaging would be basic to statistical analysis and prediction of river conditions.[41]



During the Civil War the Union Gunboat "Cairo" was scuttled in the Yazoo River to avoid capture. Raised in pieces a century later, the historic relic awaits possible but improbable restoration.

By 1874, the River was regaining some of its pre-war attention. In that year, a flood demonstrated just how defunct the levees were. Well over a hundred miles of crevasses had occurred within the presently defined Memphis District. A special report indicated that the failures could be attributed to five principal causes: (1) Poor levee organization, (2) Insufficient heights of levees (3) Injudicious cross sections and construction (4) Inadequate arrangements for inspecting and guarding, and (5) Faulty locations.[42]

Adding to the interest in the river was both the return of the luxury steamboats and the fascinating spectacle of frequent steamboat races. The most famous of these races was, of course, the 1870 race between the *Robert E. Lee* and the *Natchez.* Thousands gathered on the shores and cannons roared in salute as the ships boiled by. That celebrated race of 1,200 miles, from New Orleans to St. Louis, focused national attention on the river as never before. The *Lee's* record time of three days, eighteen hours and fourteen minutes[43] was all the more impressive because it was upriver. The record triggered subsequent and frequently disastrous attempts to set a new record, but it was not until 1929 that the *Lee's* record was broken. A Dr. Louis Leroy, operating a speedboat named *Bogie,* bettered the record that year, but by only three hours.[44]



Currier and Ives' version of the historic July 4, 1870 race between the "Robert E. Lee" and the "Natchez." Actually, the two steamboats were never as close together as this lithograph would indicate. The event has been called the greatest of all steamship races.

A new era of River Romanticism was opened up with the *Lee-Natchez* race. Paradoxically, this new Romanticism came at a time when railroads were beginning to undermine western waterways as a principal means of travel and transportation. The historic completion in 1869 of the first transcontinental railway, at Promotory Point, Utah, was followed by a mushrooming web of railway networks which threatened disaster to river commerce and travel. Rivermen shuddered with the thought that the rivers would be restricted by additional bridges. The first Mississippi bridge, completed in 1856 at Rock Island, Illinois, had already claimed sixty-four steamboats.[45] Now the rails threatened not only the physical safety but the economic security of the steamboats. In 1873, a direct challenge was created with the first thru train between New Orleans and Chicago. Thereafter, the river could not offer competition in speed of travel, but only in the pleasure of travel and in economy of shipping. Ben Burman has said that the steamboat still allowed one to travel "not in fever but in leisure."[46]

Demonstrating the efficiency of river commerce, the *Mary Belle*, in 1876, arrived at New Orleans with a cargo of 7,829 bales of cotton and 19,000 sacks of cotton seed, a total cargo of 3,300 tons and she was still not loaded to total capacity.[47] The trains of the period would have required 110 cars to carry as much and the expense would have been many times greater. At the time of this writing, the comparison is even more mind boggling. A single barge can carry the equivalent of thirty box cars, and a single large "tow," *i.e.* a group of barges lashed together for transport, may consist of forty or more barges. Thus one barge tow will transport as much tonnage as twelve trains of 100 cars each.[48] The ever-expanding railroad systems had easily demonstratable advantages, but transportation on the Mississippi and its major tributaries would endure. A vast segment of the economy was deeply involved in Mississippi commerce, and those who depended on the efficiency and economy of river commerce kept up the pressure for river improvement.

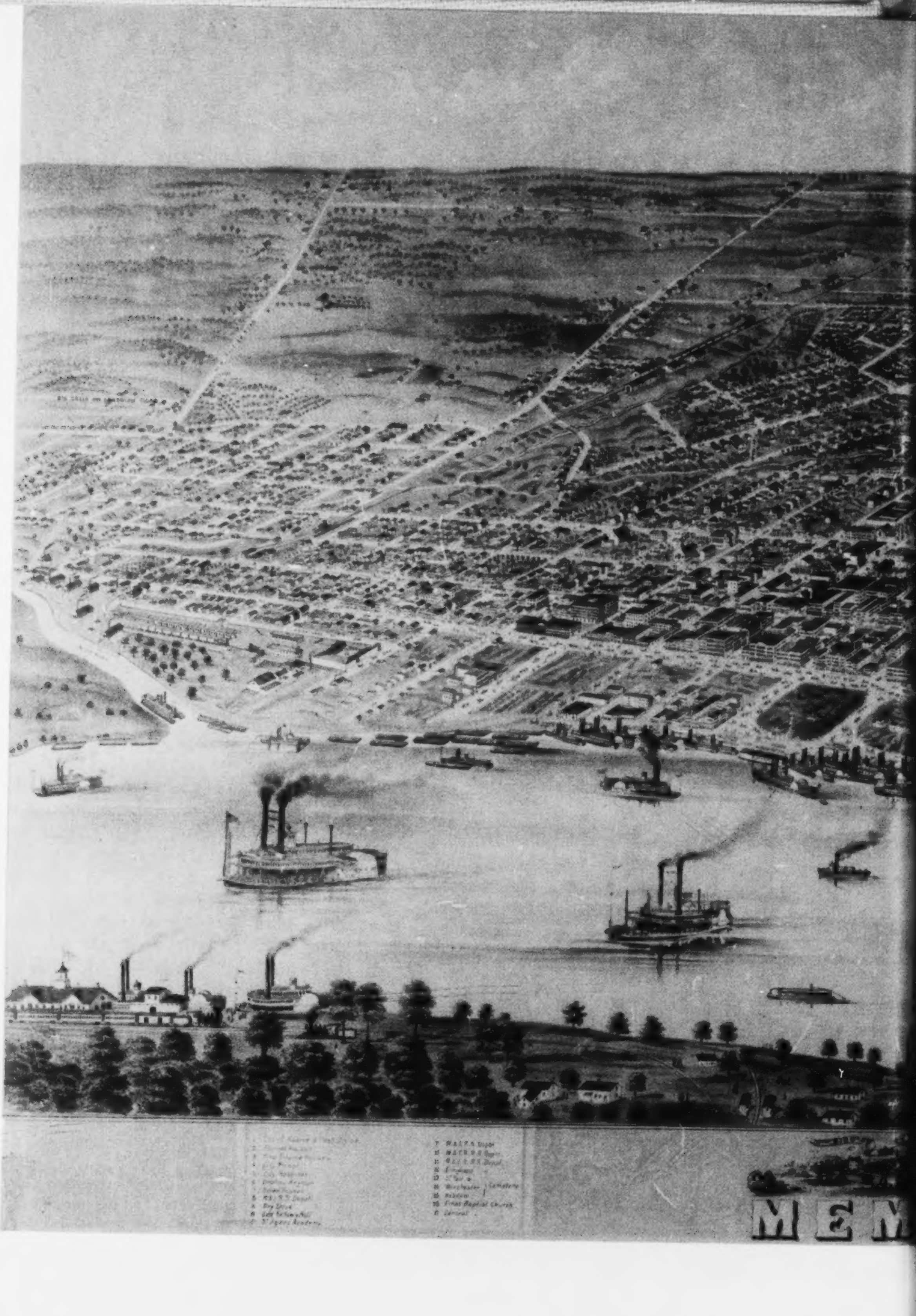
In June of 1874, Congress appropriated $10,000 for a new survey of the Lower Mississippi River between Cairo and New Orleans, with the objective of studying the feasibility of maintaining a channel of from eight to ten feet in this stretch. Col. Charles R. Suter, Corps of Engineers, conducted the survey, and his survey updated previous knowledge of the river. From the deck of a Government steamer, the survey party covered the stretch between Cairo and Vicksburg four times. The completed map, published on a scale of 1 inch to 1 mile, showed all topographic features such as islands, towheads, dry bars, etc., as well as the low-water channel at the time of the survey.[49]

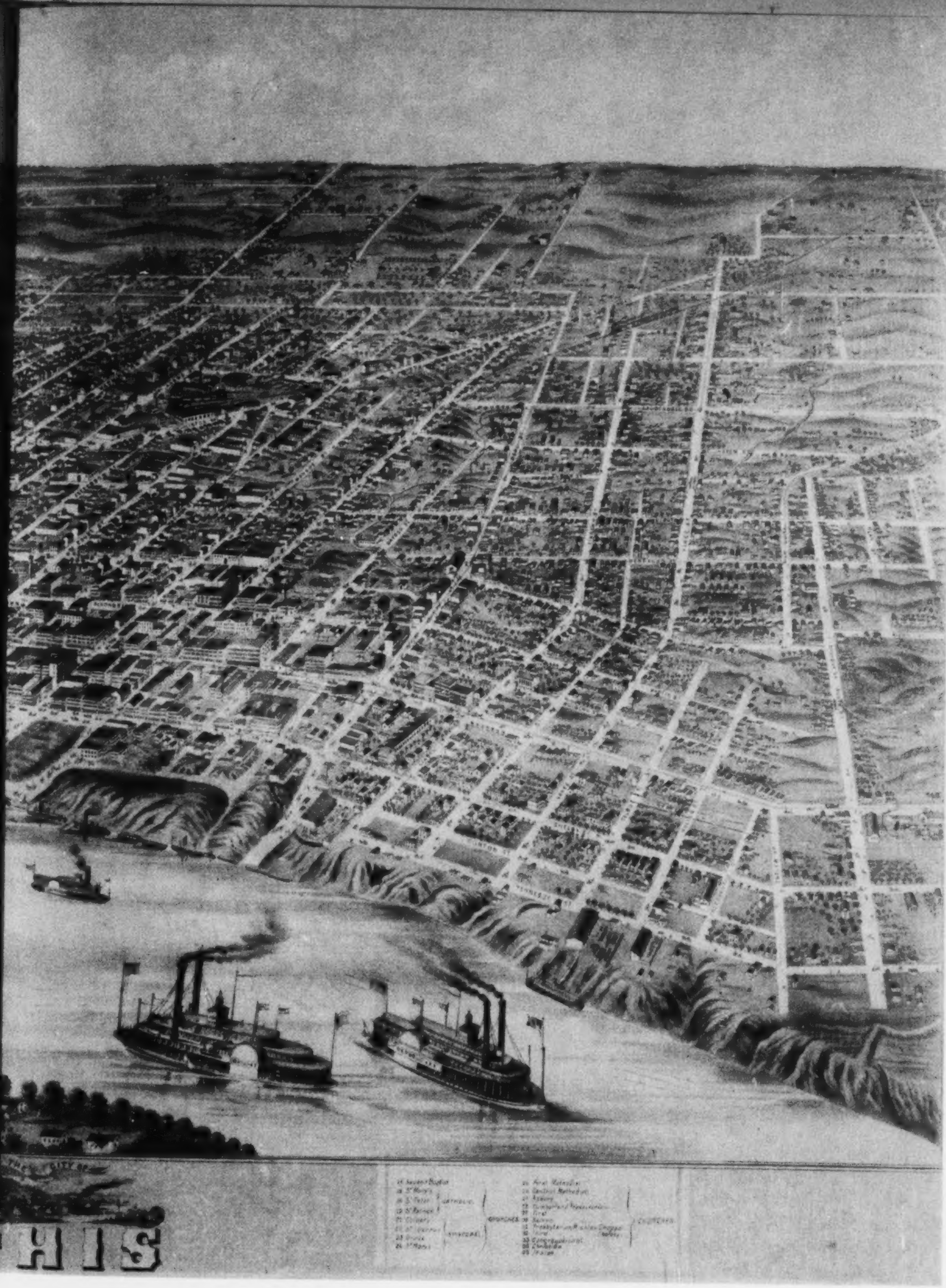
In 1874 Congress authorized the President to create a Commission to study "reclamation and redemption" of lands in the alluvial basin of the Mississippi Valley.[50] This Commission of five, three of whom were officers of the Corps of Engineers, reported the need for a permanent commission of broader authority.[51] Another acknowledgment of this need was evident in 1878 when the Committee was supplemented by the creation of the Board of Engineers, charged with the preparation of a systematic plan of river improvement.[52] From the floor of the Senate, James A. Garfield (R-Ohio), later to become President of the United States, made the crucial point in stating that the Mississippi River was "one of the grandest of our material national interests in the largest sense of the word, and too vast for any authority less than the Nation's to handle."[53]

The ultimate goal of a single comprehensive agency was finally answered in 1879, when in a historic decision, Congress authorized the creation of the Mississippi River Commission (MRC). By this Act, the previous Boards were dissolved, though the Engineer Departments remained for a while. Coordinated efforts to improve the Mississippi date from the formation of the Mississippi River Commission.

ROBT.E.LEE
547

A rare picture of the "Robert E. Lee," engaged in its more mundane routine of commerce and passenger business. A typical scene at a cotton port.


First Baptist Church
Cemetery
MEM



Artists' conception of Memphis, 1870.

CHAPTER II

The Engineers Take Hold

The Act which created the MRC charged it with the task of preparing surveys, examinations and investigations to improve the river channel. Also, the MRC was given the task of protecting the banks of the river, improving navigation, preventing destructive floods, and promoting and facilitating commerce and the Postal Service.[1] By law, the Commission was to be composed of seven Presidential Appointees, three of whom would be officers of the Engineer Corps of the Army, one from the U. S. Coast and Geodetic Survey, and three from civil life. It was also stipulated that the President of the Commission would be selected from among the three Corps of Engineers members. For a while there was some overlapping of authority, as the Engineer officers who were located at Harbor and Ports continued to exercise authority directly under the Engineer Departments. The resident Engineer at Memphis operated under the command of the Office of Western River Improvements, which was headquartered in St. Louis.[2]

In the initial reorganization following the creation of the MRC, the Lower Mississippi was to be administered directly by the MRC. The authority was broadly stated, but narrowly restricted. Although the MRC was technically charged with tasks previously stated, along with keeping the mouth of the passes open, the Commission in fact was severely limited; it was limited by lack of funds and limited in its flood control efforts. Public opinion at the time was so massively opposed to federal intervention that until 1917 Congress dared not reveal the use of federal funds for protection of private property in times of flood. Such appropriations as were made for that purpose, between 1879 and 1917, had to be publicly proclaimed as applying to navigation.[3] The MRC had its first meeting in Washington, D.C., in August of 1879. General Q. A. Gillmore was appointed President of the Commission, and it was decided that St. Louis would be the "permanent" headquarters.[4]

As might be expected, the early period of the MRC was one of fact gathering, but the Commission also labored along with the burden of being directly responsible for the work of improvement of the Mississippi. They employed personnel while trying to acquire plant and materials to accomplish the tasks, but by 1882 it was obvious to all that there had to be a division of responsibilities. In August of 1882, Congress enacted a River and Harbor Act which relieved the MRC of the responsibility of carrying on the work of improving the River. Thenceforth the MRC would be the planning agency, and the actual work would be done by the Engineer Department of the Army.

The Engineer Department, at the MRC's suggestion, subsequently opted to divide the Lower Mississippi into four separate Districts, each under a District Engineer. The First District extended from Cairo to the foot of Island No. 40, a distance of 220 miles. The District Engineer for the First District was initially located at Cairo. The Second District extended from Island No. 40 to the mouth of the White River, a distance of 180 miles. Captain A. M. Miller was appointed District Engineer, and made his headquarters in Memphis. The Third District extended from the south end of the Second District to Warrenton, Mississippi, a distance of 220 miles. For a while the headquarters for the

Third District was located at Vicksburg, then was relocated to Memphis. The Fourth District, extending from Warrenton to the Head of the Passes, a distance of 484 miles, was headquartered in New Orleans.[5]

The operations proved cumbersome with the First District administered from Cairo, so, in 1885, that District headquarters was also moved to Memphis. For a while, all of the District headquarters operating out of Memphis were kept as entirely separate operations, although they operated out of the same building at 282 Main Street, but Captain Smith S. Leach served concurrently as the District Engineer for both the First and Second Districts. This custom continued through subsequent appointments until June of 1890, when the duplication was ended with the official consolidation of the First and Second Districts; thereafter, the Engineer at Memphis was known as the District Engineer for the First and Second MRC Districts.

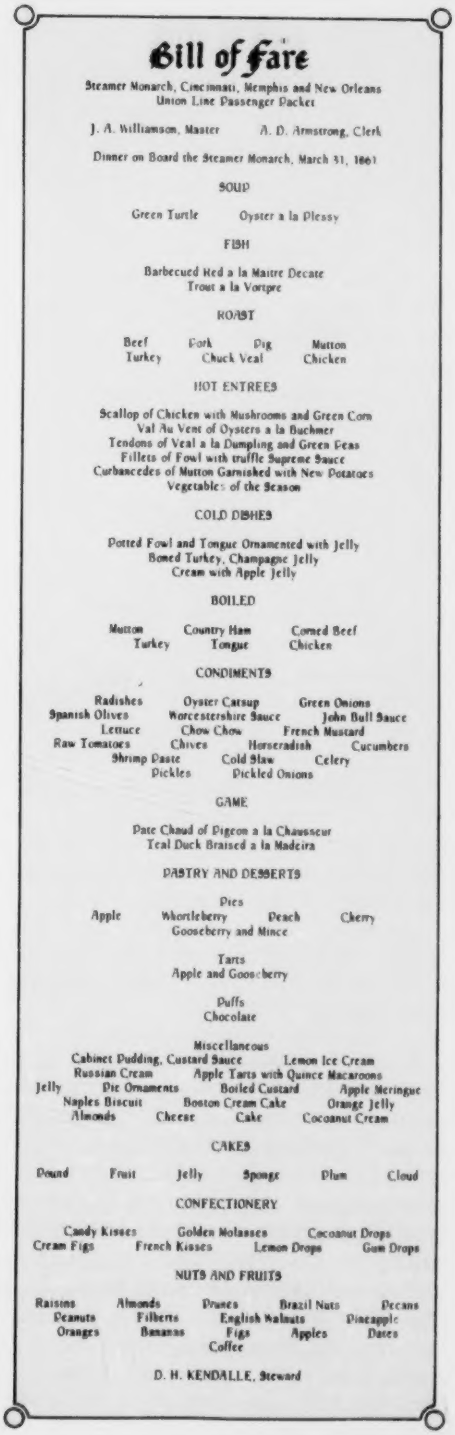
The Engineer for the Third District, directing more remote activities, remained separate. The first two districts, although administered now as one unit, would retain the cumbersome title of First and Second Districts until 1928, when in an efficiency move the Districts were reorganized and the First and Second Districts were dissolved into the new Memphis Engineer District. At that time the boundaries of the district were extended slightly, but for the purpose of this history the First and Second District embraced what is essentially the present day boundaries of the Memphis District. At the same time that the Memphis District was created, the other Districts were renamed to be the Vicksburg District and the New Orleans District. As part of the same organizational move, the headquarters of the MRC was moved from St. Louis to Vicksburg.[6]

Main salon of the short-lived "Bluff City" sternwheeler. 1896.

In 1879, the only areas of bank stabilization within the presently defined District were the river fronts of major ports. It was well recognized that river obstruction accrued largely from caving banks, but the concept of protecting a thousand miles of river banks was beyond the scope of contemporary thinking. Harbor towns, on the other hand, could appreciate the vital necessity of maintaining a safe and useful landing for river craft, therefore town fathers and commercial interests were willing to expend their own funds to protect river frontage. At one time, the towns absorbed the entire cost of the projects, such as they were, but those privately financed efforts were inadequate at the time and totally incapable of meeting the demands of increasing river traffic.

The city of Memphis had taken the lead in trying to secure its landings, but the problem was immense. The Bluffs, while high, were of

The Bill of Fare of the Steamer "Monarch," March 31, 1861, indicating that the luxurious appointments of the steamer were matched by the cuisine.



Bill of Fare

Steamer Monarch, Cincinnati, Memphis and New Orleans
Union Line Passenger Packet

J. A. Williamson, Master   A. D. Armstrong, Clerk

Dinner on Board the Steamer Monarch, March 31, 1861

SOUP

Green Turtle   Oyster a la Plessy

FISH

Barbecued Red a la Maitre Decate
Trout a la Vortpre

ROAST

Beef   Pork   Pig   Mutton
Turkey   Chuck Veal   Chicken

HOT ENTREES

Scallop of Chicken with Mushrooms and Green Corn
Val Au Vent of Oysters a la Buchmer
Tendons of Veal a la Dumpling and Green Peas
Fillets of Fowl with truffle Supreme Sauce
Curbancedes of Mutton Garnished with New Potatoes
Vegetables of the Season

COLD DISHES

Potted Fowl and Tongue Ornamented with Jelly
Boned Turkey, Champagne Jelly
Cream with Apple Jelly

BOILED

Mutton   Country Ham   Corned Beef
Turkey   Tongue   Chicken

CONDIMENTS

Radishes   Oyster Catsup   Green Onions
Spanish Olives   Worcestershire Sauce   John Bull Sauce
Lettuce   Chow Chow   French Mustard
Raw Tomatoes   Chives   Horseradish   Cucumbers
Shrimp Paste   Cold Slaw   Celery
Pickles   Pickled Onions

GAME

Pate Chaud of Pigeon a la Chausseur
Teal Duck Braised a la Madeira

PASTRY AND DESSERTS

Pies
Apple   Whortleberry   Peach   Cherry
Gooseberry and Mince

Tarts
Apple and Gooseberry

Puffs
Chocolate

Miscellaneous
Cabinet Pudding, Custard Sauce   Lemon Ice Cream
Russian Cream   Apple Tarts with Quince Macaroons
Jelly   Pie Ornaments   Boiled Custard   Apple Meringue
Naples Biscuit   Boston Cream Cake   Orange Jelly
Almonds   Cheese   Cake   Cocoanut Cream

CAKES

Pound   Fruit   Jelly   Sponge   Plum   Cloud

CONFECTIONERY

Candy Kisses   Golden Molasses   Cocoanut Drops
Cream Figs   French Kisses   Lemon Drops   Gum Drops

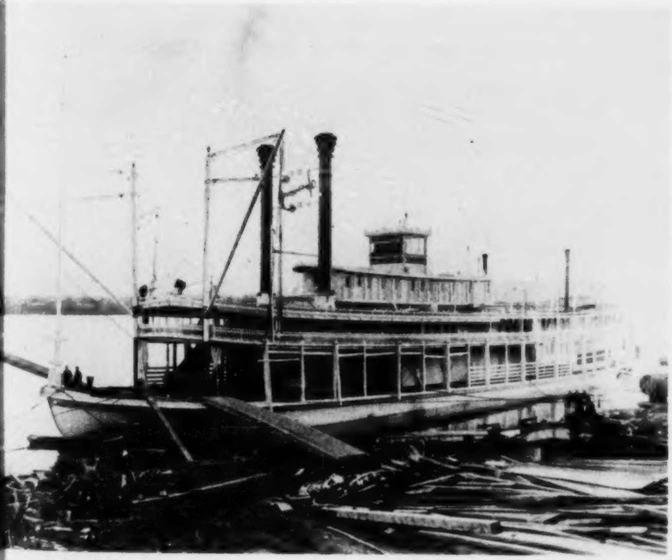
NUTS AND FRUITS

Raisins   Almonds   Prunes   Brazil Nuts   Pecans
Peanuts   Filberts   English Walnuts   Pineapple
Oranges   Bananas   Figs   Apples   Dates
Coffee

D. H. KENDALLE, Steward

soft, erodible material and the Mississippi waters chewed away tons of the material with each passing day. Inversely, the River might deposit silt before the city and block off the normal landings. That erosion and build-up problem was one of the great problems to which both the city and the engineers addressed themselves. Demonstrating the magnitude of that problem is the story of a sandbar that began to form at Memphis in the mid-1830's. Within two years, the city was blocked by a 1,000 foot sand beach. The new beach was quickly covered with brush and willow trees, and the whole thing seemed so stable that the engineers constructed their navy yard upon it. Within the next twenty

The only sternwheel Anchor line steamer ever built, the "Bluff City" was relatively small but luxurious, despite the clutter of the landing place. Built in 1896, it survived but one year before being destroyed by fire.



years, over one million dollars in buildings and machinery was installed on the new land, and no one doubted the permanency of the situation. In the 1860's, however, another shift in river currents reversed the island build-up and began the erosion of the island. The navy yard had to be abandoned as the bulk of the sandbar, along with the navy yard installations, fell victim to the ravenous appetite of the River.[7]

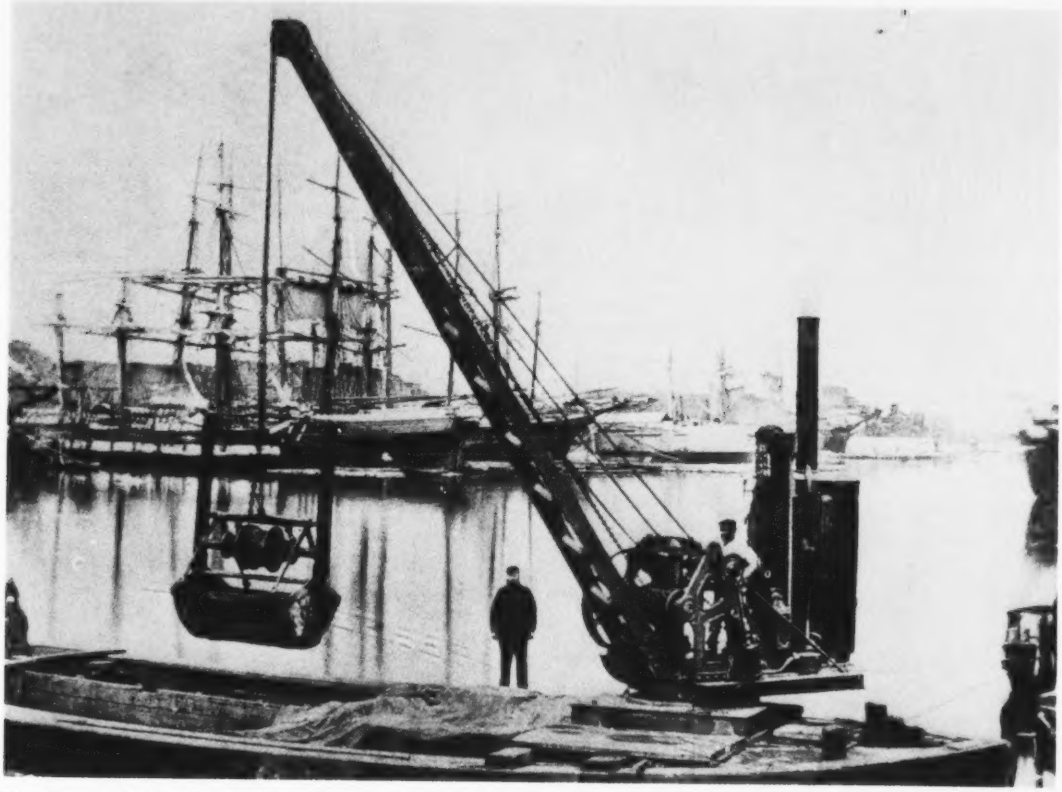
In the 1870's, the River was again eating away at the Bluffs. Between 1873 and 1876 over 350 feet of bluff had caved in at the foot of Jefferson Street, and the process was continuing at the rate of about 100 feet per year. The erosion rate above Wolf River was even greater. In 1877, following a survey, the engineers recommended that 7,600 foot section of river-front be protected, thus the stretch from above the Wolf River to the elevator at the foot of Beale Street would be the scene of the first major effort at bank protection.[8] It is noteworthy that this effort, largely financed by the city, preceded the formation of the Mississippi River Commission.

There are basically two ways in which a bank can be protected. In one method, wing dams may be built out at right angles to the bank, thus breaking the current before it can reach the bank. The other method is to place some sort of protective cloak on the bank itself. The laying of a protective mattress on a bank was the first type of revetment work undertaken in this District. While the modern mat ("mattress") is a sophisticated articulated concrete mattress laid by even more sophisticated machinery, the early efforts were in keeping with the technology of the period, and further limited by the scarcity of funds.

The type of mattress used at that time was that which had been developed in Germany during the 12th century.[9] Brush was systematically cross-stacked in layers to a depth of 3 to 5 feet and the "mattress" was then tied together. Finally, the assembled "mattress" was floated into position, where it was then weighed down and sunk with rocks. The life of such a mat was normally assumed to be about thirty years, provided that it stayed in place long enough for trees, other growth, and sediment, to anchor it even more securely. However, it often happened that the mat would be lost in the placing, or would be washed away by the first high water.

The mattresses laid on the Memphis water front in 1878 were only 125x50 feet, and work was halted after the first two because of

Traditional willow mat under construction at Sunflower Landing, Mississippi. December, 1927.

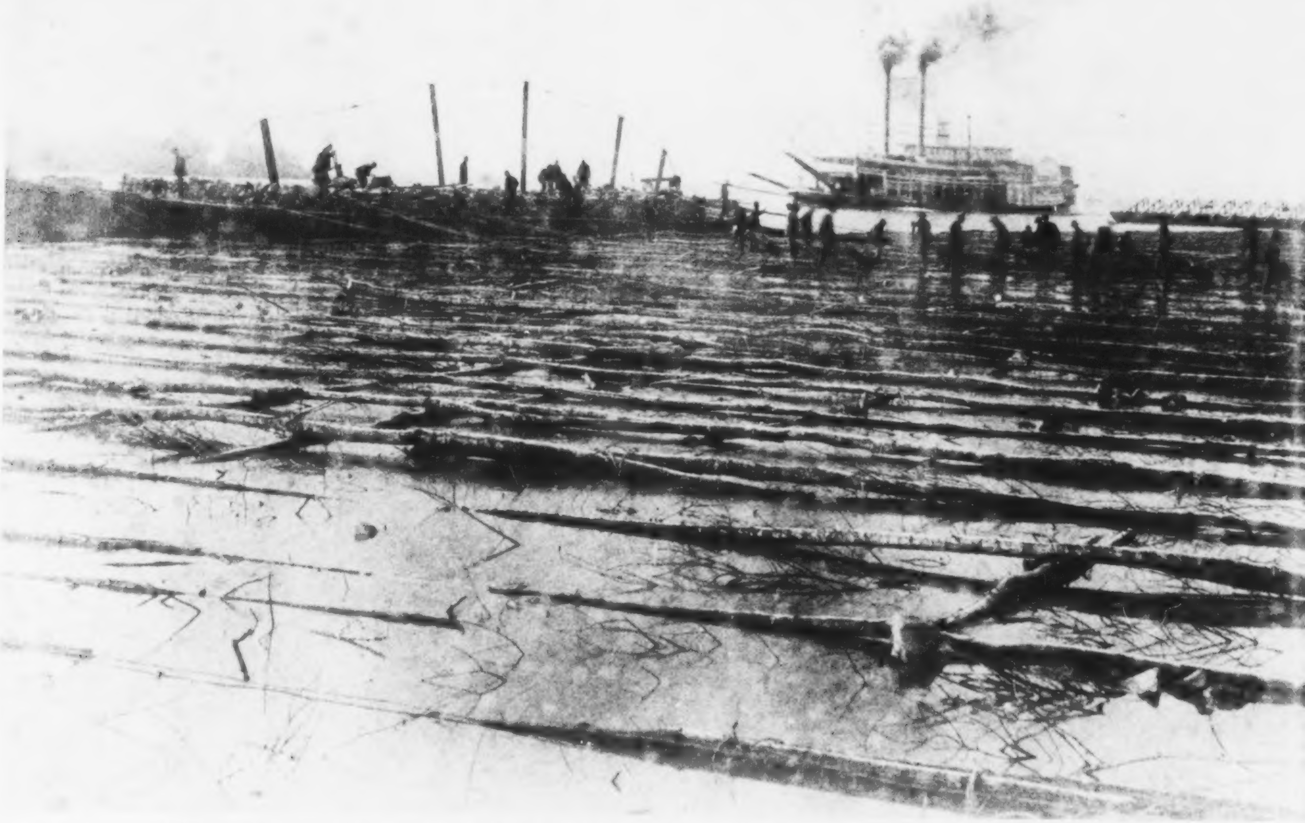


The first Grab Dredger, built by Messrs. Priestman Bros., Ltd., for Dock and Harbour Dredging in 1878. Note that chains were used to operate the bucket. The later innovation of stranded, steel cables would greatly increase the reliability and longevity of the grab dredger, but the suction dredge would render it obsolete.

the return of the Yellow Fever plague. On the 16th of August only five of the seventy-five workers showed up, and work was suspended. Eventually 42 men died in what was then considered a mysterious plague.[10]

In 1879 work was resumed, but after the upper bank was graded and a 40-ft. mat was in place,[11] a second siege of yellow fever again closed down operations.

The grading of the upper bank prior to the laying of a mattress had been a laborous pick and shovel task, but one of the contemporary developments in the art was the introduction of hydraulic jet grading. By this method, river water, pumped under 80-85 pounds pressure, was used to hose down and erode the upper bank to the proper grade of 45 degrees. After the upper bank was graded, a light mattress of about eight inches in thickness was laid over the slope and weighed down with rocks.[12] The upper bank revetment prevented water from washing behind the lower mattress. The stone which is used in the upper bank paving is called riprap, and is broken stone with an average thickness of 10 inches.[13] As experience was gained the engineers found that it was necessary to extend subaqueous revetment beyond the "toe," *i.e.* the point at which the slope reaches the more or less flat bed of the channel deepening, the mat would be laid as little as 20 or 30 feet beyond that point, or perhaps as much as 200 or 300 feet beyond that point.[14] Subaqueous mat was found to be under attack from all sides and edges



Willow mattress being sunk at infamous Plum Point, as side-wheeler steamboat plows its way upriver in the course of routine business. About 1882. To the right-center of the picture is a mat launching barge, designed so that the assembled mattress will slide off when released.

(flanking), even down river where eddy currents prevailed.[15] The present day mattress is the end result of a long series of experiments which will be detailed later in proper sequence.

Bank protection for the entire length of the River seemed to be out of the question, yet caving and erosion of banks was central to the problem of the river, and eventually the nation would have to face that problem directly. In 1901 it was estimated that the annual rate of caving, per mile of river, was about nine acres, with erosion reaching a volume of 972,092 cubic yards per mile. Furthermore, two-thirds of the erosion went into the building of bars obstructing navigation.[16] Erosion was a triple liability: good land would be lost by the farmer, silt deposits would impede navigation, and channel changes would occur. Complete bank stabilization, even today, has never been achieved, and may never be, but the struggle continues.

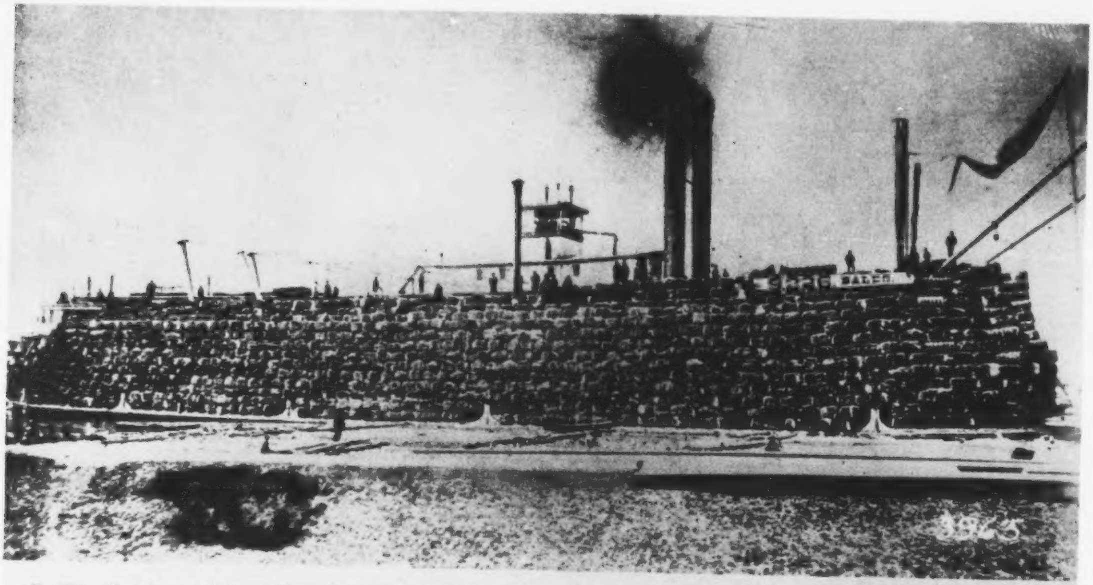
From time to time it had been suggested that the banks would be more secure and flood waters would be removed more quickly if the River were straightened out by cutting through the bends. The cut-off program was as old as nature, for in fact the River would periodically cut through the base of a loop and leave the old channel to fill in and vegetate. It was believed that the engineers could accelerate that tendency by digging through the neck of a bend and letting the River scour out a new channel.

The cut-off idea had been proposed in the earliest of the reports, but in the 19th century the disadvantages were considered to outweigh the advantages. While recognizing that flood waters would be carried away more quickly by a straighter channel, the engineers also noted that the channel would run shallow in times of low water, perhaps too shallow for navigation. Also, it was noted that water would never be content to flow in a straight line, that it had a tendency to oscillate at all times until a meander was established.[17] The natural meander of the Mississippi River is more pronounced than in most rivers because the riverbed is of rather low profile and of exceedingly soft material.

Just before the creation of the MRC, the River had created a natural cut-off about 44 miles above Memphis. Centennial, or Devil's Elbow cut-off, occurred when the main channel cut through Fogleman's chute to bypass Brandywine Island. The new channel, in turn, created a situation wherein a small chute behind Beef Island then carried an increasing flow until it too broke through to become the main channel. By this double cut-off the river was shortened by some 30 miles. Such an occurrence would invariably cause the water level to drop and harbors to shoal, as happened at Memphis.[18]

One can easily see that by this cut-off process the main channel might move several miles away from its previous location. Dr. H. N. Fisk, of Louisiana State University, made a study of the meandering bed of the

The fight to save Hopefield Point was both constant and futile. Here we see workers trying to construct a protective mattress on the slope of the levee. Note the simplicity of the operation. The levee, along with most of Hopefield Point, is long gone. About 1890.



The "Henry Frank" carried the Record Cargo of Cotton ever attained by a River Steamboat. The Photograph shows this great boat as she arrived at New Orleans, April 12, 1881, with 9,226 Bales of Uncompressed Cotton on Board. (Photograph from the James R. Mullens Collection.)

Mississippi and found that the river had occupied as many as twenty-six "well-defined" different channels, all within a meander belt of some fifty miles in width.[19]

The early effort at bank revetment had resulted in a hard learned lesson. Active caving seemed to be accelerated where small detached mats were placed. In other words, a small mat was worse than no mat at all. The obvious answer was continuous revetment of the whole troubled area, but engineering considerations would always be balanced against practical economics.[20]

As nature would have it, the MRC and its fledgling organization was almost immediately burdened with one of the greatest floods in the history of the valley. At Memphis, the River was in flood from January to March, 1882, one of the most extended periods in the recorded history of the River.[21] Even though the history of the Mississippi is a history of frequent floods, the growing density of settlement within the valley, plus the embryonic levee system, made each major flood more disastrous than the previous and the 1882 flood was a perfect example of this effect. As early as January 29, rail traffic between Memphis and Little Rock was being curtailed.[22] By mid-February business was at a standstill in Memphis because all the boat landings were under water. A 400-foot break in a levee below Helena was flooding thousands of acres of bottom land, and the railroad trestle above Marianna was reported under water.[23] The waters continued to rise under the impetus of continuing heavy rains and winds of 30 to 40 mph. The winds caused waves that washed over the levees that protected the town of Helena, and alarm bells tolled out a story of distress.[24]

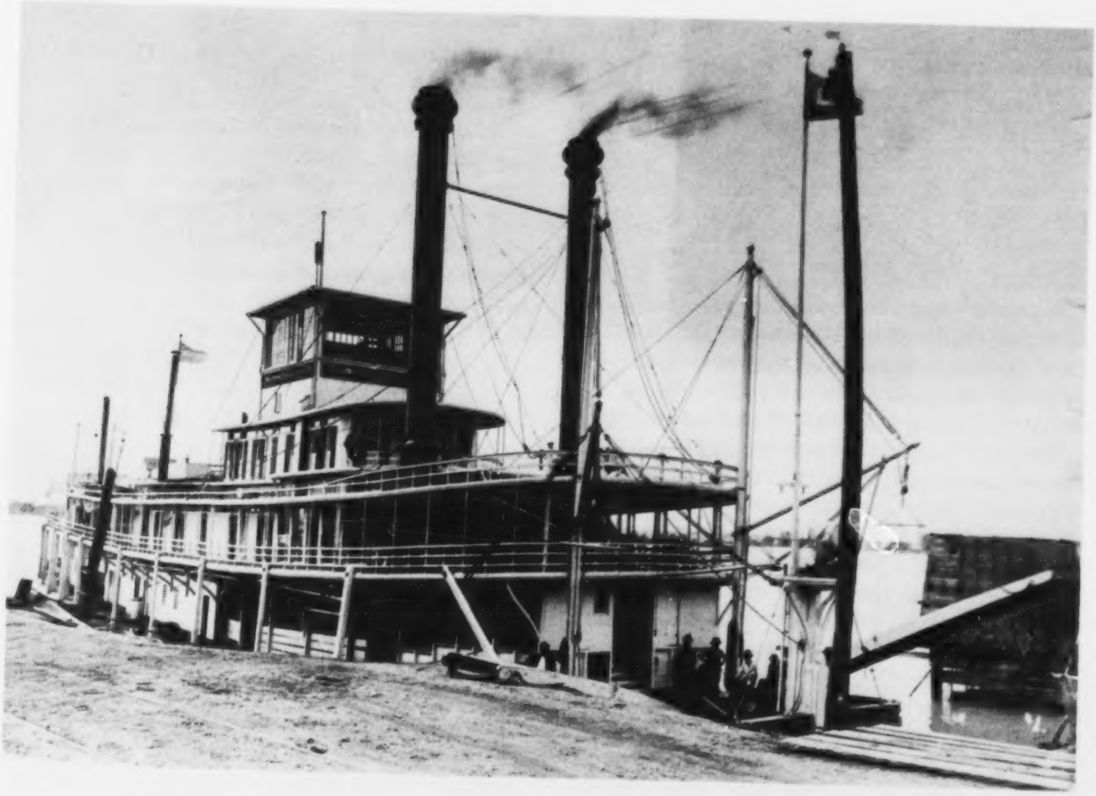
Levee breaks occurred with frightening regularity over the next several days. In Arkansas, the counties of Crittenden, Lee, and Phillips were hardest hit, while in Mississippi, DeSoto, Tunica, and Coahoma Counties were flooded. The town of Hopefield, across the river from Memphis, was completely under water, as was Arkansas City. By February 23, the *New York Times* was reporting that there were only twelve points of land visible between Cairo and Memphis. Deep water extended through the St. Francis and White River valleys. In Desha County, Arkansas, it was reported that for 40 miles the only dry spot was a mound of sawdust about 16 feet in diameter, and sixteen people had been buried there.[25] Throughout Arkansas, Mississippi, and Missouri came reports of drownings and disaster. Houses, cabins, livestock and trees were tumbled along in the wash of the flood. It was reported that 28 miles of the Memphis and Little Rock railroad was under water.[26]

Even as the Secretary of War, Robert Lincoln, ordered distribution of tens of thousands of rations to refugees, the advocates of river improvement were using the flood as a lever for more liberal levee appropriations.[27] But tragedies continued to mount on tragedies as the flood waters kept up their relentless pressure. At Austin, Mississippi, the River smashed the levee before the town, and twenty feet of water covered the village.[28] One Arkansas refugee, making his way to safety in a dugout, reported that the Black Oak Ridge area was under water for the first time in history. This same refugee estimated that over 10,000 cattle had been lost in his area alone.[28] Captain J. M. Lee of the Corps of Engineers, working with a government relief squad, reported that – for twenty miles below Memphis – the entire country was flooded and the flood plain was fifty miles wide at some points.[29] Pemiscot County, Missouri, was entirely submerged. Starving and isolated people at Hathaway, Tiptonville, and Hales Point, in Tennessee, and at Bayfield Point and Osceola, in Arkansas, were desperately awaiting relief from the Corps of Engineers.[30] It was even reported that people in the Upper St. Francis were "almost" reduced to cannibalism."[31]

The flood clearly demonstrated the inadequacy of privately built and piecemeal levee systems. Mr. Thomas H. Allen of Thomas H. Allen and Company, a large plantation corporation headquartered in Memphis, pointed out the futility of such a system. Mr. Allen noted that the levees were so totally inadequate for the control of the river that a steamboat could venture from Pine Bluff to the Gulf of Mexico without ever entering the Mississippi River.[32]

By the end of March the flood was receding, but the public clamor for flood control was just beginning to reach its stride. In April, President Chester A. Arthur requested that Congress make available an additional one million dollars for closing the gaps in existing levees and, in response, Congress sent a Committee to tour the Lower Mississippi. From their chartered steamboat, the *Guiding Star*, the Congressional Committee seemed to draw the conclusion that the whole thing was hopeless.[33] Another group, also taking an inspection trip down the

Mississippi, drew an entirely different opinion. The Mississippi River Commission had its first occasion to use the steamboat *Mississippi I*, a craft that had been specially built for just such a purpose, and the tour convinced the MRC that a good levee system could have prevented the disaster.[34] Local interests and newspapers were highly pessimistic about anything being done, however, because of what was considered "traditional" indifference – if not the hostility – of "New York and Eastern" interests. The Cotton Exchange was so sure that a plea for flood control assistance was out of the question that they confined their request to a plea for help in improving the river front. This simple request, after members of the exchange consulted with Major W. H. Benyaurd of the Corps of Engineers, was sent to Congress along with a memorial and left out all mention of the flood problems.[35]



The first of the Steamers named "Mississippi" (1882-1921), on an Inspection Trip.

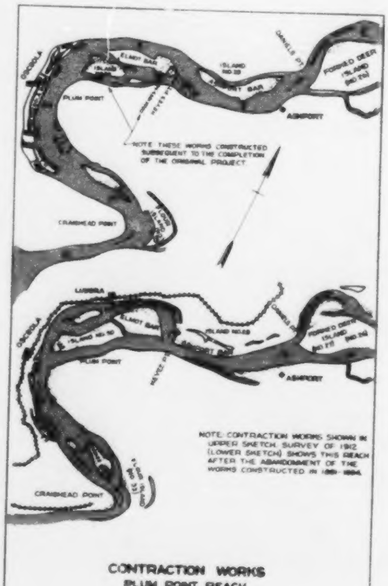
The River and Harbor Act of August 2, 1882, gave the MRC its first money for improving the Lower Mississippi. However, the appropriation of $4,123,000 was tethered to the stipulation that none of the money was to be used to build protective levees.[36] The horrendous destruction caused by the Flood of 1882 had failed to shake the traditional position relating to levees as a private and state responsibility. Internal improvements had been viewed with suspicion from the earliest days of the Nation, and that suspicion was not to be eliminated for several years yet to come.

After the flood of 1882 the First and Second Districts were overwhelmed with demands for both snag removal and the replacement of channel lights. Those channel lights were greatly appreciated by all rivermen, but Mark Twain, in his humorous style, remarked that the government had "knocked the romance out of piloting" by installing channel lights.[37]

Snagging continued to be the most obvious and most immediately beneficial work that the Districts could undertake. Requests for new steel-hulled snagboats became an unfailing part of each year's budget request. Sometimes it was possible to place iron plate over the older snagboat hulls and thus extend their usefulness for a few years, but the snagboats themselves were often the victims of snags.

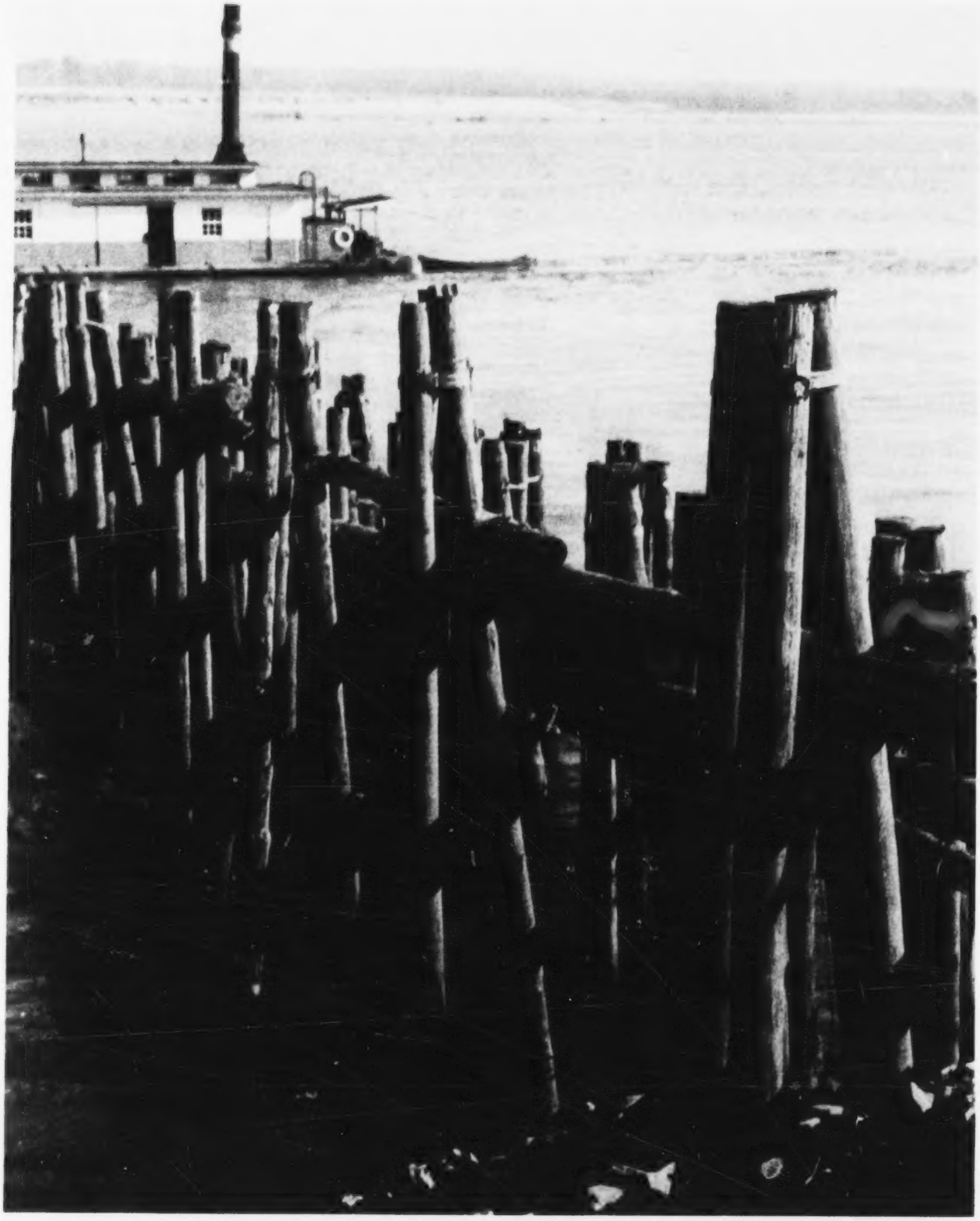
The most troublesome reach in the Districts was the bend known as Plum Point. Throughout the seventeen mile stretch, the river was wide, the banks were low, the sediment was loose, the bars moved constantly, and the snags were thick. Mark Twain recalled from his days as a Mississippi pilot that Plum Point was the most talked about reach of the river, and the test of a pilot's river proficiency.[38] From Ashport to Craighead Point, the area was one of constant menace and a graveyard of sunken or beached steamboats. Osceola, at the apex of the bend, could be kept open to navigation only with the greatest difficulty. The engineers expended a disproportionate amount of time and money trying to keep the Plum Point reach open in the belief that if they could solve the problems there then they could handle problems anywhere else on the river. Thus it was that their first truly major effort at channel and bank stabilization took place at Plum Point.

The effort to stabilize the channel through the reach was made in two parts: (1) Constrict the river to a narrower and thus deeper channel by building dikes out from the banks, and (2) Secure the banks at the bends by means of protective willow mattresses. The mats could also be placed at the footing of the dikes in an effort to keep the dikes from being undermined and washed away. Although there would be some experimentation with various forms of mattresses, as will be explained, most were of the standard type previously described. When the mats were placed at the footing of the dikes they were weighed down with heavier stone than used in simple revetment.


OSCEOLA
ELMOT BAR
ISLAND
PLUM POINT
ISLAND NO 29
ASHPORT BAR
DANIELS PT
FORKED DEER ISLAND
ASHPORT
NOTE: THESE WORKS CONSTRUCTED SUBSEQUENT TO THE COMPLETION OF THE ORIGINAL PROJECT
CRAIGHEAD POINT
LUXORA
OSCEOLA
ELMOT BAR
ISLAND NO 30
ISLAND NO 29
PLUM POINT
ASHPORT
NOTE: CONTRACTION WORKS SHOWN IN UPPER SKETCH. SURVEY OF 1912 (LOWER SKETCH) SHOWS THIS REACH AFTER THE ABANDONMENT OF THE WORKS CONSTRUCTED IN 1881-1884.
CRAIGHEAD POINT

CONTRACTION WORKS
PLUM POINT REACH
1881-1884

SCALE
0 1 2 3 4 MILES



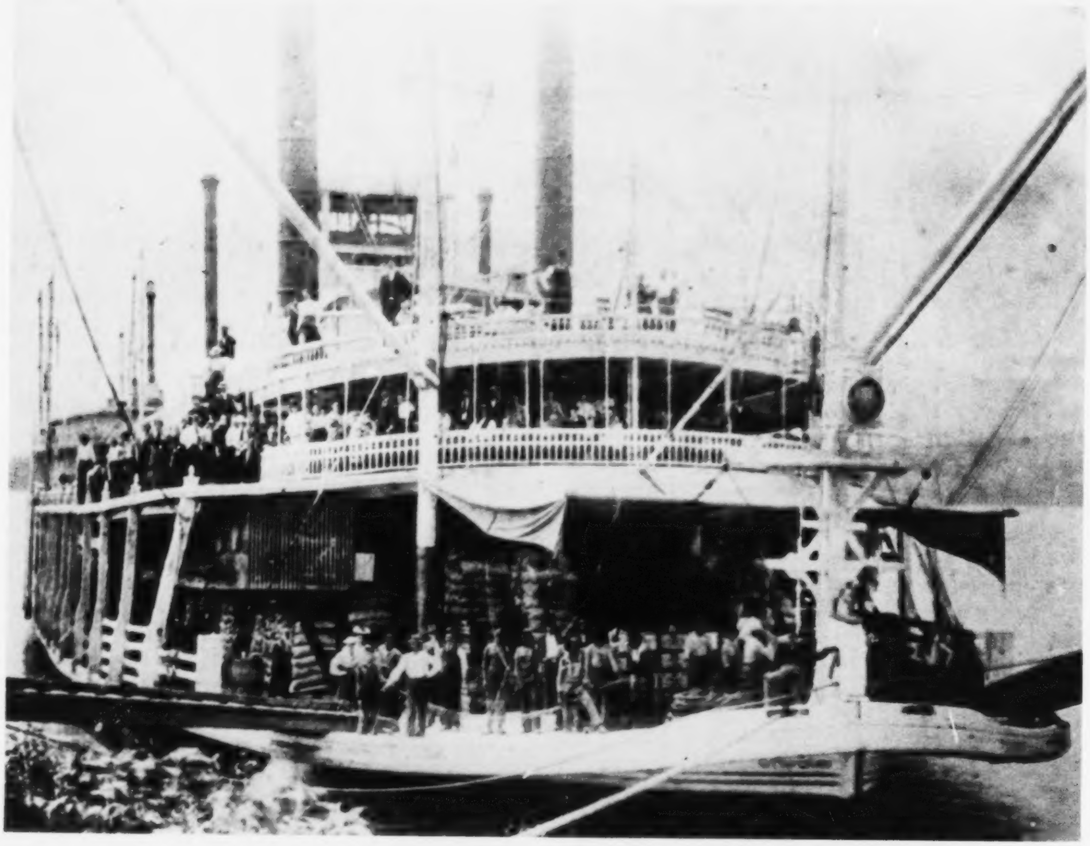
A heavy duty dike at Bells Point, Missouri, consisting of a triple row of three-stack piles, all lashed together. Experience had proved, however, that no dike was immovable.

There were many delays before the work at Plum Point began in earnest. Captain Sears, District Engineer in charge of the First and Second Districts, ordered a fleet of work and quarter boats to Plum Point, but other work in the Districts had to be considered.[39] As Captain Sears remarked somewhat drily, "the parties at each end (of the Districts) desire that the work be done to the neglect of that at the other."[40]

Also compounding the problems was another flood in 1883. Although not of the same magnitude, it did undo the repair work that had been started after the flood of 1882, and it wrecked the schedule of proposed contraction works. After the waters had subsided, the Plum Point project was resumed with the construction of a dike designed to deflect the waters before Elmot bar. Others were placed at Keyes Point, and revetments were placed on the bar before Osceola while contraction dikes were placed across the river.[41] The initial improvement work at Plum Point was largely unsucessful, principally because the mattresses were often lost before being secured, and the shifting clay of the river bed caused the dikes to be insecure to the point that they would be wedged downstream even though they remained upright. By the end of 1884, the first Plum Point works were abandoned in disgust and total failure.

Of more immediate concern to the people of Memphis was the caving of Hopefield Point, across the river. At that time the main channel of the River was north and west of Frames Isle, and as it swung around the bend it was deflected by Hopefield point and bore directly on the city of Memphis. Normally the Bluff would have suffered great erosion under such a direct attack, but the river was chewing off such great chunks of Hopefield point that it was depositing heavy loads of silt before the city, deposits which would eventually build up and create Mud Island. But for the moment, the deposits were creating a twofold problem: the loss of land at Hopefield point and the creation of a mud bar that was impeding shipping in the Memphis Harbor. In an effort to correct the situation, the engineers constructed the single largest willow mattress ever known to that time. The Hopefield Point willow mat measured 1,032 feet in length and was 145 feet wide.[42] This great mattress and the supporting smaller mats, together with other mattresses being constructed for other District projects, soon created a shortage of willow brush.[43] This shortage forced the engineers to forego the laying of upper bank protection,[44] and that failure proved disastrous as the entire mattress was lost during the next high water.[45]

The growing shortage of willow brush, added to the short life span of the brush when used as upper bank "paving," accelerated the search for other revetment material. As early as May 10, 1884, Captain Frederick A. Hinman of the Engineers proposed the use of concrete slabs for revetment. Since revetment cover had to conform to the shape of the bank, even as the bank decayed, Captain Hinman proposed that the concrete be poured in sections, and that those sections be connected to each other by iron rods.[46] This was a mature concept that would be close to the final solution reached in the 1930's, but at



The "City of Cairo" No. 2 was built to replace the original which burned at New Orleans in 1873. She was a St. Louis and Memphis packet, and was part of the Anchor Line, which was created in 1867 through the merger of the old Memphis and St. Louis Packet Company and the St. Louis and Vicksburg Packet line. 1896.

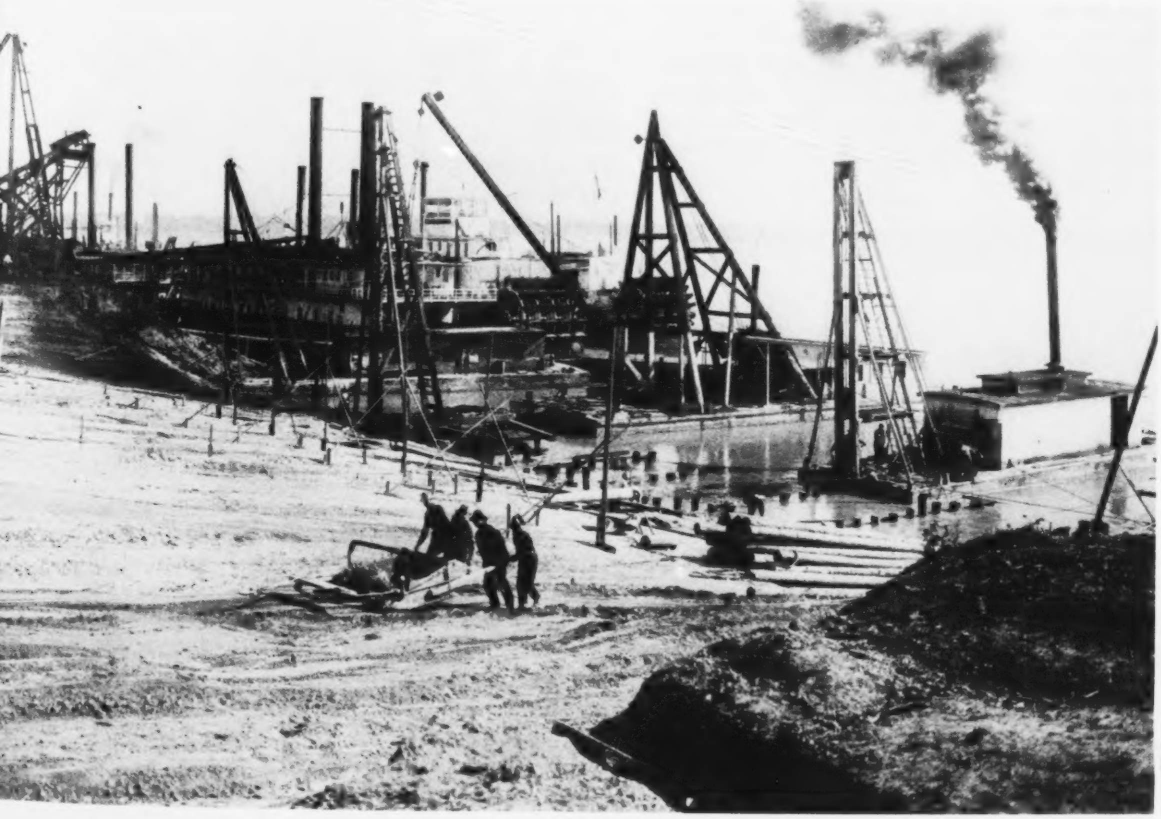
the time Captain Hinman's suggestion was premature in time of presentation. There was neither the money nor technology for expensive experimentation.

The Memphis water front continued to occupy a large amount of attention. The River and Harbor Act of July, 1884, allocated $200,000 for the protection of the harbor, and government installations therein.[47] But the harbor was being threatened on both sides. Not only was it under attack from the river, it was also being subjected to landslides precipitated by the custom of draining city water onto the bluff. Furthermore, an eddy current, created by the recession of Hopefield Point, was causing a counter current running from the foot of Market Street to the mouth of Wolf River. The greater the recession of Hopefield Point, the greater the width and speed of the eddy. The eddy current also left

The "Citizen" dikes of Memphis under constructi a deposit contribution to the growth of an embryonic Mud Island. By 1886, the change of current had brought down about 900 feet of the lower river front,[48] and the city fathers decided to levy a tax for the rectification of the harbor problems. It was decided to build spur-dikes out from the landing areas in order to break up the current, and that the city drains on the bluff would be enclosed in wooden culverts and carried down to the water's edge.[49]

Since the city of Memphis was paying for the construction of the five dikes, they became popularly known as the "citizen dikes," and the name was often applied to similar projects at other river towns. The dikes were constructed by building a wooden crib, floating it to position, and then sinking and anchoring it in place by filling it with stone. The $60,000 which had been raised by the town fathers did not complete the job, but the slack was taken up by the government.[50]

The citizen dikes did their job quite well, as did the wooden culverts. The dikes not only broke up the current which had been eroding



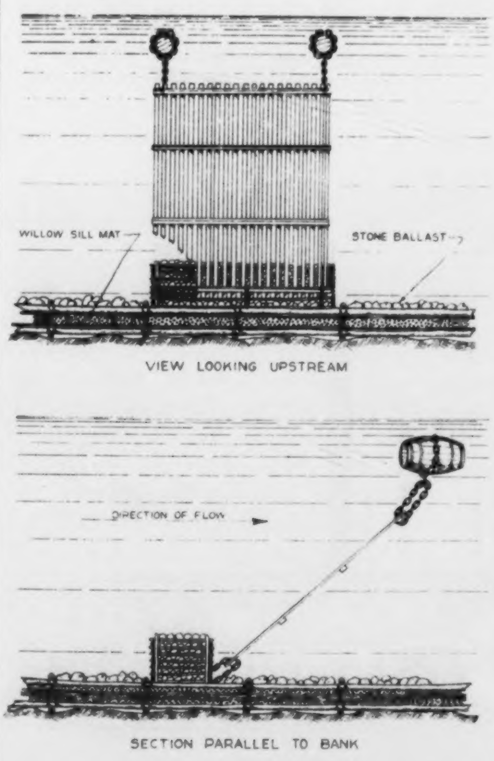
the banks, they also provided anchorage for the steamboats. By 1889, the engineers had taken over the maintenance and improvement of the dikes, and, at that time, the original dikes were covered with more stone and topped with a layer of top soil, so as to make them "permanent" and useable as landings.[51] The apparent success of the citizen dikes brought similar efforts in Kentucky at both Columbus and Hickman. In each case, five rock-crib spur-dikes were planned, though not completed.[52] A spur-dike project was also begun for the protection of Helena Harbor in 1889.[53] But not all river towns were adjudged in need of protection at the time. Osceola was already protected by the sand bar that had formed in front of the city, and by the continuing efforts of the Corps of Engineers to stabilize the channel in the Plum Point reach. New Madrid was deemed unusually stable so no work was contemplated there.

Helena had another serious problem, other than the usual river front erosion and fill problem. The town was in constant danger of being flanked by the river from both above and below. In 1886, the town was "electrified" by news of a levee break above the town. The crevasse was so large that the tug *Eva,* along with its entire tow, had been sucked through and beached several hundred yards inland. The water poured through the break and flooded some 8,000 acres under cultivation and the Fair Grounds at Helena. It was reported that the water thundered through the crevasse with such violence that the roar could be heard at great distances.[54]

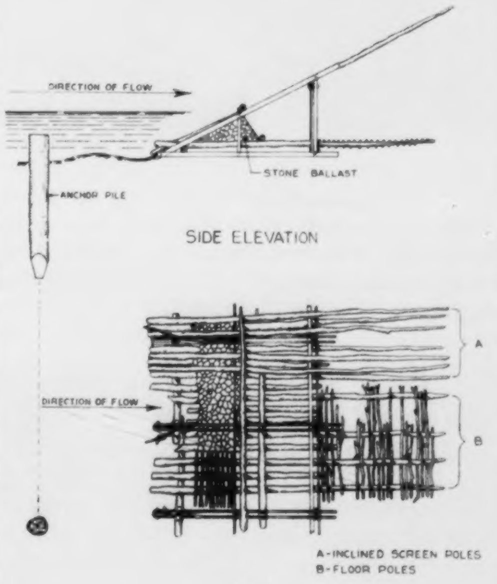
As if the River alone was not enough of a menace, both ships and improvement works faced several instances of floating ice which carried as far as the mouth of the Arkansas River. In December of 1872 a great ice gorge broke loose about forty miles upriver from Memphis, rumbled almost intact into Memphis Harbor, and crashed "with a terrible force" against the ships at anchor there. Dozens of steam ships and barges were sunk or damaged, along with the dock facilities, and the financial loss was estimated at about $500,000.[55] In 1887, the Memphis *Appeal* reported that for a distance of nearly two miles, from Hopefield Point to President's Isle, the River was a vast sheet of broken, floating ice.[56] Such ice could easily rip boat hulls and grind up revetment works. It was fortunate that ice on the Lower River was not an annual occurrence.

The engineers continued to attack the problems of the Plum Point reach, but with varying degrees of success. By the early 1890's most of the earlier effort was lost, but each failure brought new knowledge. Various types of dikes were tried in an effort to overcome local conditions. The dikes, or wing dams, were constructed by driving pilings in a line from the bank to the edge of the proposed channel, then tying the piles together and constructing a frame between them. Mattresses were then laid at the base of the pilings to keep a scour from eating away and undermining the pile group. Parallel dikes tended to create slack water between them, and it was assumed that silt and debris would settle out and fill in the intervening areas. As previously mentioned, however, the bed of the river was unstable, and the continuous pressure of the current kept undermining and shifting the dikes. In an attempt to halt this erosive action, piles were driven deeper, then multiple piles were driven in pyramid groups and lashed together. But this effort still failed to solve the problem. When the line of piles were so secure that water could not smash the dikes, it was noted "with some amazement" that a whole section of a dike line might be moved back, with lashings and connections intact.[57]

The mattresses placed at the footing of the piles were supposed to protect them from scour, but the mats themselves presented a large area of resistance and tended to either break up or form an impermeable wall that contributed to the deterioration of the dike. A genuine plateau of achievement was reached in this area of experimentation when it was discovered that an all stone dike was much superior to subaqueous mattresses and lashed piles. At the same time the use of brush as upper bank revetment was abandoned in favor of the all-stone riprap revetment.[58]


WILLOW SILL MAT
STONE BALLAST
VIEW LOOKING UPSTREAM
DIRECTION OF FLOW
SECTION PARALLEL TO BANK

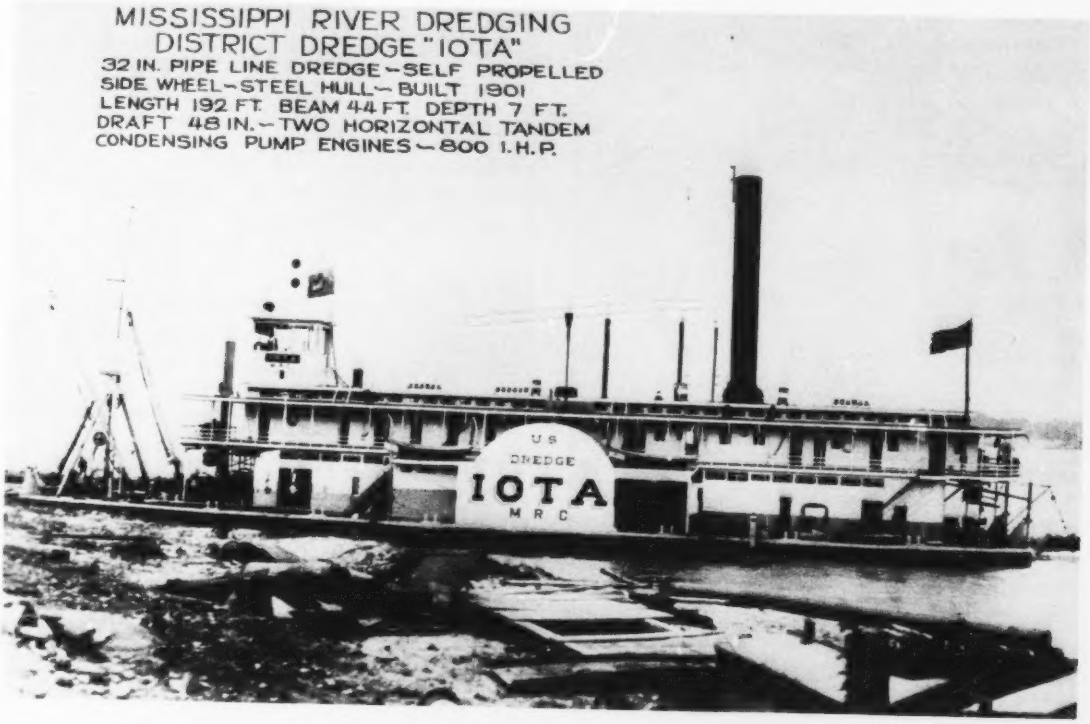
THE SCREEN DIKE

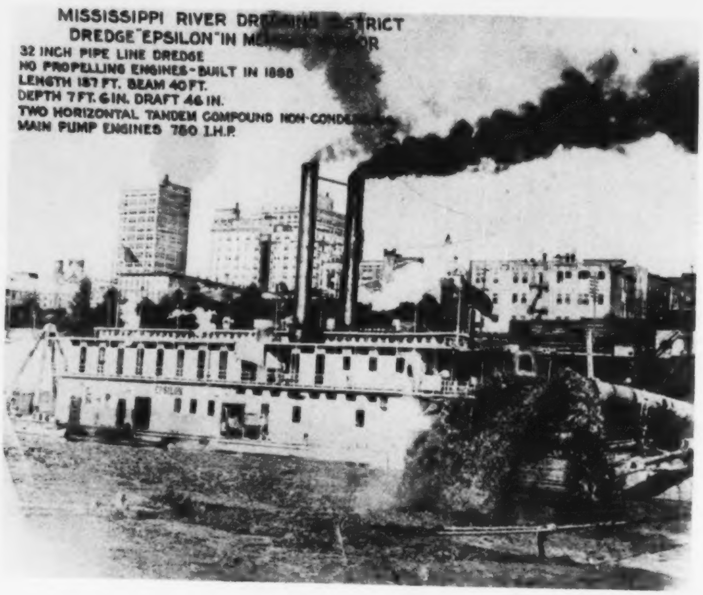

DIRECTION OF FLOW
STONE BALLAST
ANCHOR PILE
SIDE ELEVATION
DIRECTION OF FLOW
A
B
A-INCLINED SCREEN POLES
B-FLOOR POLES
PLAN

THE ABATTIS DIKE

Some variations of the dike concept were most interesting. All were designed to cope with the difficult conditions of Plum Point. In one short-lived experiment the engineers attempted to cope with problems of floating debris by designing a current deflector that would be a floating screen, thus permitting debris to float above the "dike" when the pressure became too great. The screen was made of latticed wood, and was anchored by chain to stone cribs. The top of the screen was kept in suspension by floating barrels to which the screen was attached, again by chain. The concept, although practical in theory, failed because of the difficulty of keeping the screens afloat.[59]

Another variation of the spur dike was the abattis dike, which was a water deflector device built in a wedge shape. The Abattis dike was constructed of wood and was weighted down by rock ballast, with the incline facing the flow of current. The Abattis dike had worked on other rivers, but enjoyed only partial success in the Mississippi. The pure stone dike seems to have been the most unqualified success to come out of the Plum Point experiments, and led Major E. Eveleth Winslow to state confidently, but erroneously, that "the last pile dikes to be built in the District" had been built.[60]


MISSISSIPPI RIVER DREDGING
DISTRICT DREDGE "IOTA"
32 IN. PIPE LINE DREDGE – SELF PROPELLED
SIDE WHEEL – STEEL HULL – BUILT 1901
LENGTH 192 FT. BEAM 44 FT. DEPTH 7 FT.
DRAFT 48 IN. – TWO HORIZONTAL TANDEM
CONDENSING PUMP ENGINES – 800 I.H.P.

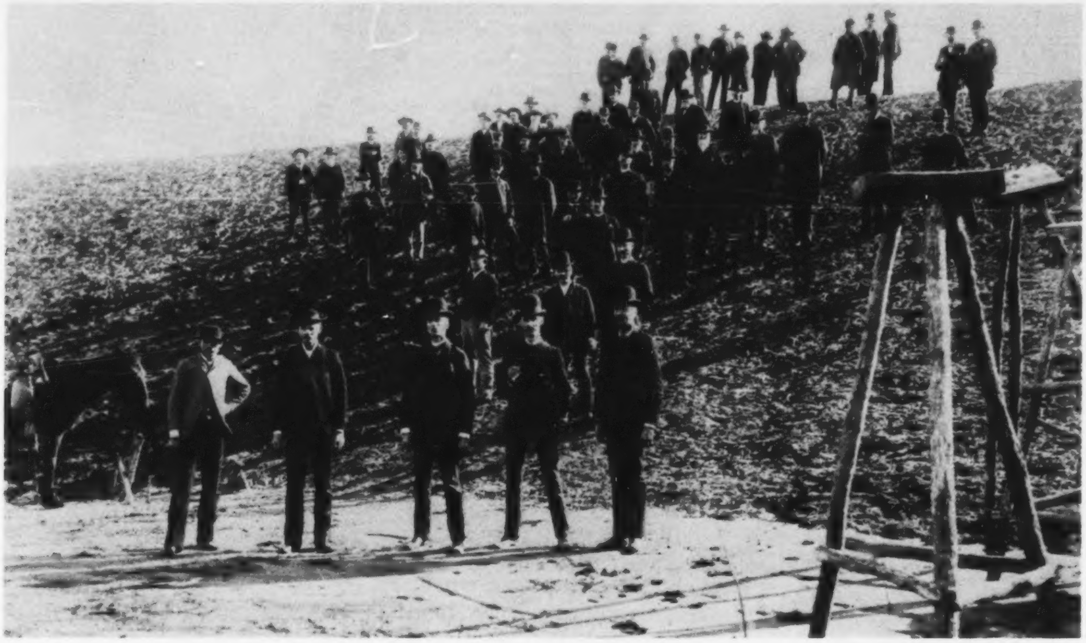

MISSISSIPPI RIVER DR
RICT
DREDGE "EPSILON" IN M
OR
32 INCH PIPE LINE DREDGE
NO PROPELLING ENGINES - BUILT IN 1898
LENGTH 187 FT. BEAM 40 FT.
DEPTH 7 FT. 6 IN. DRAFT 46 IN.
TWO HORIZONTAL TANDEM COMPOUND NON-CONDE
MAIN PUMP ENGINES 750 I.H.P.

The dredge "Epsilon" was in service in the District through the first quarter of the century. Note that the sediment discharge is so heavy as to appear solid.

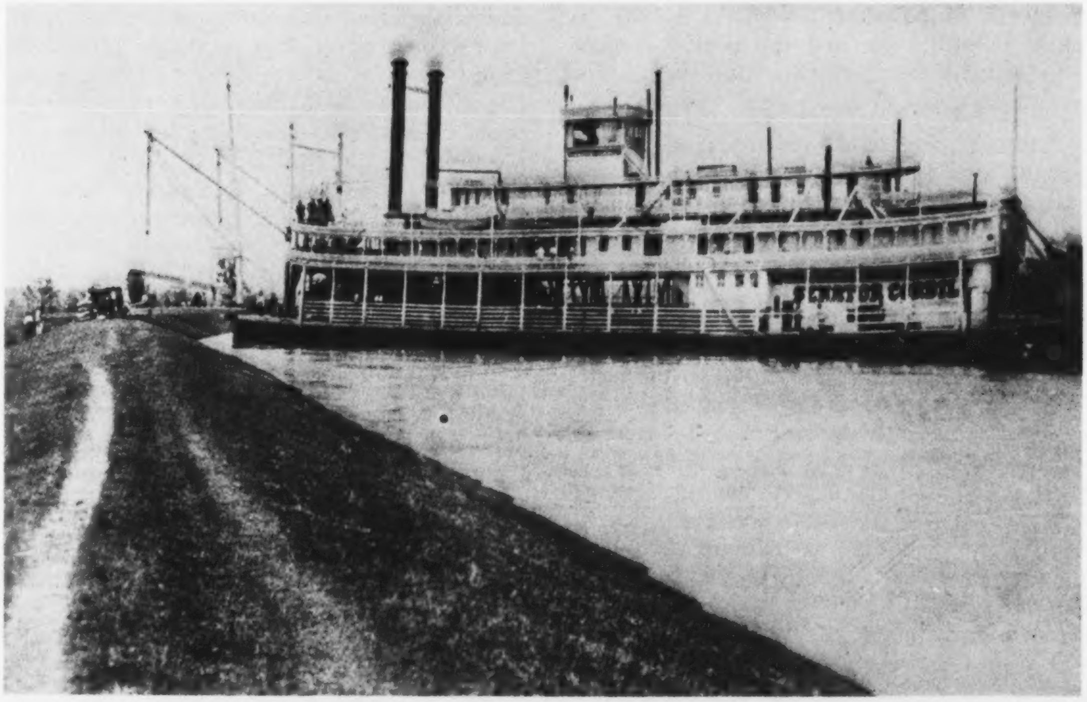
Plum Point proved to be a Graduate School of Experience for the engineers, just as it had been for the river pilots. Within ten years the engineers found that the River would go where it would go, and the best that man could do was to help stabilize it in the route it was seeking.

Another successful development of the period, also designed to help maintain the navigation channel, was the growing emphasis on dredging. Harrowing of sandbars was a long accepted principle of river engineering, but that method still depended on the erosive and scouring action of the current. Proper dredging, *i.e.*, the *removal* of material, did not make a significant appearance until the post-Civil War era, and dredging did not arrive within the presently defined Memphis District until around 1891. It was in that year that the MRC decided to investigate channel dredging as a method of maintaining minimum channel depth and as a method of maintaining channel alignment.[61] Previously such dredge work as had been done was accomplished through the use of a drag line and bucket, but the process was slow and expensive. Now the emphasis was put on hydraulic dredging. The hydraulic dredge operated on the principle of a vacuum cleaner; a large pan head would be lowered to the desired depth and, as scrapers would loosen the material, the material would be sucked up by the pan, deposited on barges and transported to a dumping area. A great improvement over this workable procedure came with the development of floating discharge pipes. With this idea, the material could be deposited directly in the fill area and the dredge could work around the clock. The hydraulic dredge is a fascinating piece of machinery, and to one contemporary author it presents this picture: "It is a huge, awkward creature. . . . like an elephant with an enormous trunk that stretches an eighth of a mile across the river, a huge pipe line with which it sucks up the gluey mud of the river bottom. Day and night it labors, pumping, grumbling, moving forward foot by foot, ceasing only for a few moments to clean away the timbers clogging its vast metal mouth, or when it must swing its long trunk aside to let some impatient steamboat pass."[62]

The basic concept of the hydraulic dredge has never changed to this day, although there are some improvements and variations in terms of the cutterhead. Even the early hydraulic dredges were capable of removing 1,000 cubic yards of material per hour.[63] Considering the one-yard scoop capacity of



Engineers and construction crew pause to commemorate the completion of a new levee. Note a scattering of Confederate uniforms. The cameraman was expected. (Photo about 1890).



The Natchez and Bayou Sara Packet "Senator Cordell" did much of its business at informal and non-scheduled stops along the levee, a practice especially common to river packets.

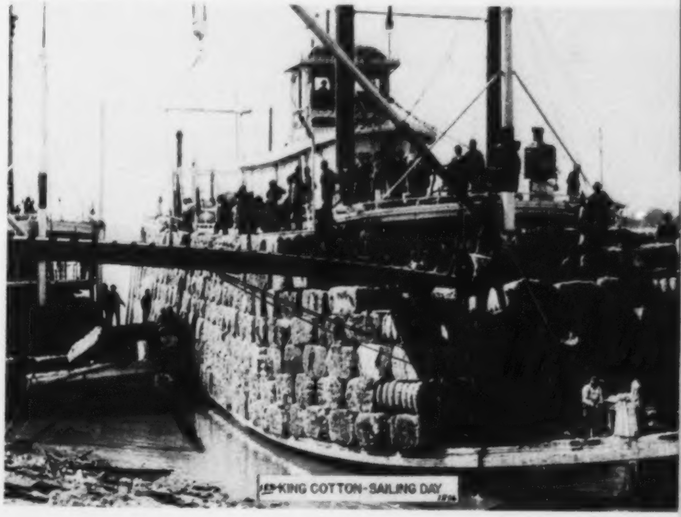
the old dipper dredge, and its daylight schedule, one can readily understand the efficiency and economy of the hydraulic dredges.

Although the Mississippi River must always occupy the place of central importance in the District, other navigable rivers required maintenance activities, and in some cases the District(s) shared responsibility with other Districts. The White River was one such river. Since the greater length of the White River seemed to fall logically within the Little Rock District, it was decided that the Little Rock District would be responsible for navigation on the White above the city of Newport, while the First and Second District would be responsible for navigation below Newport. Quite unlike the Mississippi, the White ran clear and swiftly, but there was also another difference. The engineers assumed that navigation above Newport would be more difficult than below, as was usually the case in any river, but this was not true on the White, which ran narrow but deep above Newport. Three locks and dams were scheduled for the upper river (above Newport), in the belief that these locks and dams would guarantee navigation as far as Forsythe, Missouri.[64] It was well recognized that the most beneficial work that could be done below Newport was that of snagging, and it was not until the Little Rock District completed the first of the proposed three locks and dams that snagging became recognized as the most beneficial work above Newport as well. The lock and dam at Newport operated for several years before being closed down and turned over to the city of Newport. Newport used the dam only to create a flood pool for recreational use, and the lock was inactivated.[65]

The St. Francis River was another river which required the attention of the District. In the 19th century the sole activity of the Corps as far as the St. Francis was concerned was snagging, and that only when funds were available. The District Engineer was constantly barraged by shipping interests who wanted to have even the smallest streams cleared for navigation.

Levee development moved forward in the 1880's, despite Congressional reluctance to expand federal funds for flood control. As early as 1886, the House Committee on Levees and Improvements of the Mississippi River reported favorably on a $3,000,000 appropriation to "close the gaps" and "strengthen" the levees of the Mississippi River.[66] However, the language of the Bill was couched in such a manner as to indicate that the levees were to aid navigation.

The Steamboat "Lady Lee" at work, 1896.



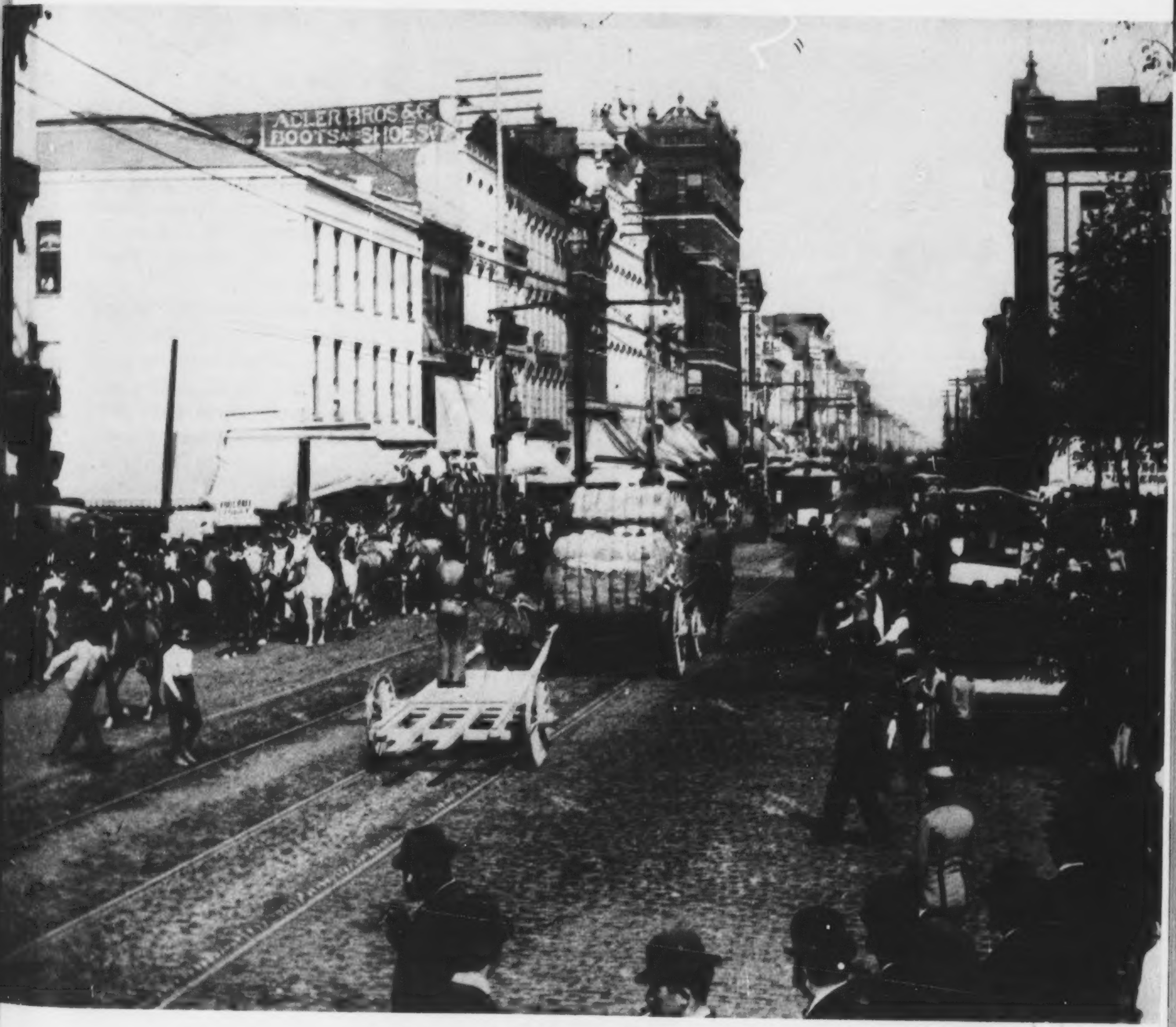
Privately the idea of a levee system was well appreciated, and most counties bordering the Mississippi and its tributaries had organized either a Levee Board or a "Friends of the Levee" organization.[67] Under an Act of 1887, the State of Arkansas created Levee Districts to eliminate the problems of multiple county levee districts. By this efficient Act, some three million acres of land in Arkansas was made subject to State taxation in support of a levee program in the St. Francis bottom area.[68] The MRC surveyed the St. Francis valley, from the New Madrid highlands to the mouth of the St. Francis. The report noted that some of the old "system" remained, and it was estimated that $500,000 would be needed to complete an "adequate" system. In all, some 6 million acres would be protected.[69] Louisiana, Mississippi, Arkansas, Missouri and Tennessee had already expended some $64,375,000 for leveeing low lands, and – at least in theory – those levees protected 23.7 million acres of land producing agricultural crops valued at $78,725,000.[70] Where no federal or state aid was forthcoming, the citizens had voluntarily taxed themselves to throw up some sort of levee.[71]

It should be pointed out, however, that not all citizens wanted a levee system. Many landowners believed that higher levees simply meant greater flood damage. One Mississippi planter put it this way: "I have always been opposed to levees and my father was before me. My idea about the levees is that they were forced upon us by the war (Civil War). We had to build them to protect the darkies. . . but as a consequence (of the levees) the bed of the river has been raised several feet."[72]

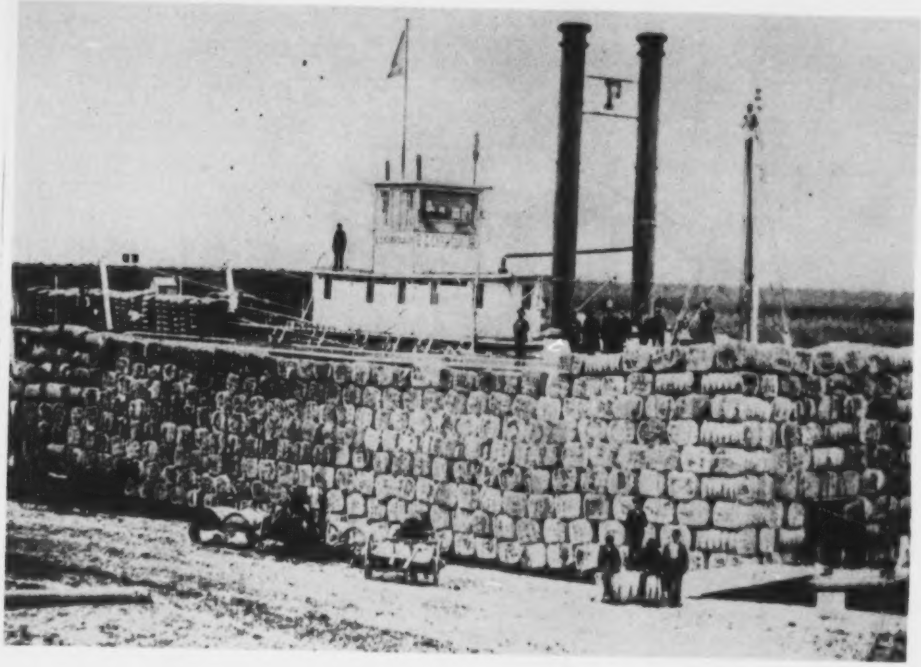
Opposition to the levees often turned into open hostility in times of flood, and one of the major problems was the guarding of the levees. Distraught landowners would seek to relieve pressure on their property by dynamiting or otherwise destroying the levees on the opposite side of the river, or at some other point that would relieve the threat to their property. In high water periods, armed guards were hired to prevent such sabotage, and "justice" was summary when someone was caught in the act. In 1890, two men were killed on the levee in Bolivar County, near Rosedale, Mississippi. No charges were made and the names of the levee guards were not published.[73]

Since the use of dynamite would invariably draw attention to the saboteurs, other methods of destroying levees were often utilized, such as cutting a small trench through a cross section, boring a hole through the levee, or even "sawing" through the levee by using a length of barbed wire. Not all damage was done by humans. Often hogs would weaken a levee by their rooting, or other animals would burrow into the levee. The Mississippi legislature passed a Hog Law which authorized the Levee Board and their agents to kill all hogs found at large within two miles of the levee.[74]

The solution to levee opposition was, of course, to build a system that would protect all property beyond the greatest known flood heights, but that solution was "pie-in-the-sky" in the 19th century. That was particularly so considering the anti-levee position of the national legislature. One apparent break in that solid stand seemed to come in September of 1890, when the River and Harbor Act omitted the customary provision that levee construction would be tethered to navigation improvement. The change in attitude was premature, however, and, by 1891, the pro-

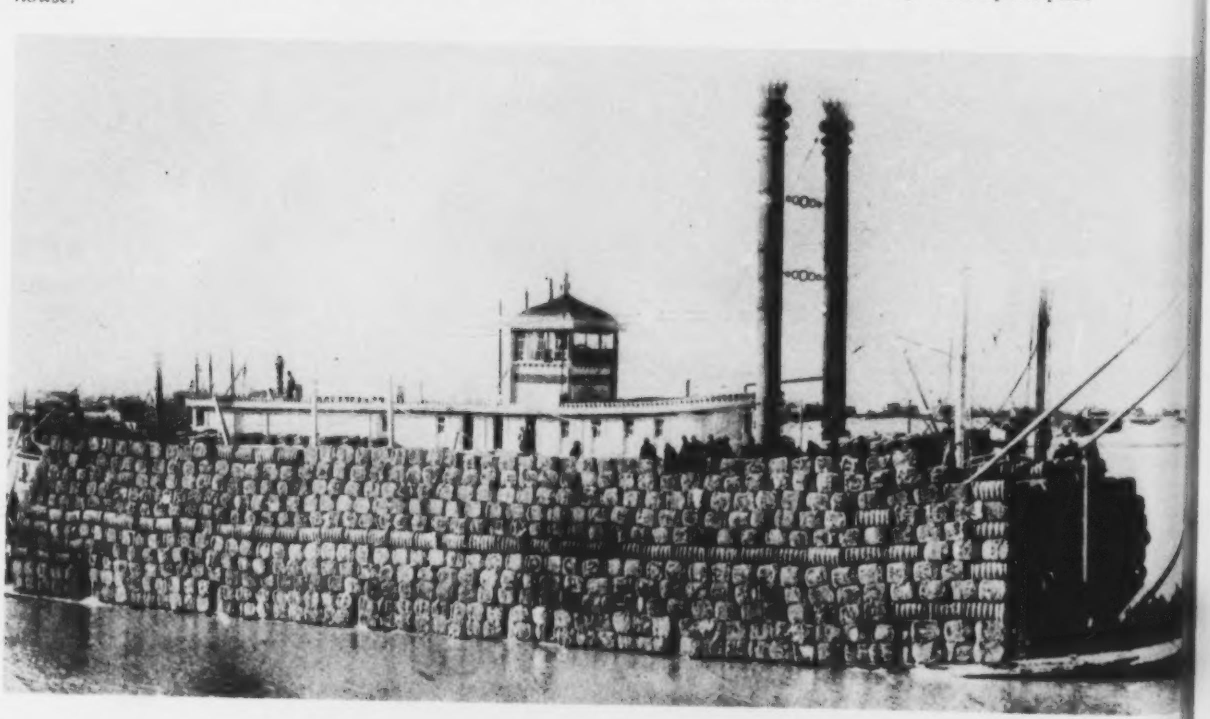

ADLER BROS & CO
BOOTS AND SHOES

River town in full blossom. Memphis, 1890.



The "E. C. Carrol, Jr.," loading cotton for transport down the Red River. At the front you will note the cotton bale entrance into the interior.

The "T. P. Leathers" entering Memphis Harbor, loaded to the waterline with 4,000 bales of cotton. Such sights were common in the 1880's and 1890's. Occasionally bales would be stacked to the level of vision of the pilot house.



vision was reinstated.[75] Only gradually would Congress and the general public come to accept the principle of national responsibility for flood control.

The 1890's witnessed the continuing struggle to keep Plum Point clear and channeled, and to sustain the other improvements made to the river and harbors. At Memphis, the citizens dikes began to sink, and the bluffs resumed a gradual caving between the dikes.[76] Across the river almost all of the Hopefield revetment of 1887-1888 was gone by 1892.[77] Plum Point was as resistant to improvement as ever, although dredging was having a salutorious effect. Some dredging was required for Memphis harbor, too, for the bar which had formed in the harbor was assuming major proportions. The engineers dredged a 1,200 foot channel to a width of 62 feet and a depth of 10 feet,[78] but could hardly keep up with the accretion. Mud Island, it seemed, would not be denied. One far-sighted citizen suggested even then that the bar be allowed to develop and that it be utilized as a landing by using wharfs to connect it to the old landing.[79]

The river was being used as never before. In 1891, despite low water, over 15,000,000 bushels of grain alone were routed down the lower Mississippi, exclusive of traffic from the Ohio River.[80] It was unfortunate that during this time of increasing need and experimental advances the nation underwent another great economic upheaval. The Panic and Depression of 1893, which was sustained for several years, plunged the nation into an era of tight-fisted economy. This economic cut-back brought a curtailment of major river improvements. River and Harbor Bills were sometimes "misplaced" by the Cleveland administration, with "much mystery" surrounding their whereabouts.[81] It was equally unfortunate that river erosion and damage could not be cut back along with funds, for, as the funds were curtailed, the improvements which had been made were gradually lost. In some cases, the engineers were specifically enjoined from doing more than minimal repair.[82]

Levee work did not suffer as much neglect simply because levees were more privately funded. In the 1890's, much progress was made in the Lower St. Francis Levee District, and in the White River Levee District. By the end of 1895, the District Engineer, Captain G. C. Fitch, reported that the Mississippi levee system was "complete" from Helena to the terminus of the District at Scrub Grass Bend, just above the White River.[83]

In 1896, an Act of Congress called for maintenance of a nine foot channel in the Lower Mississippi,[84] but the engineers had to rely largely on the new suction dredges rather than constriction of the channel.

In 1897, a major flood proved the fallacy of minimal maintenance. By March 10, the levee districts were nervously patrolling the levees, and the U. S. Steamer *Graham* was loaded with 25,000 sacks of sand to plug any possible rupture in the levees.[85] Four days later the levees were crevassing. West Memphis was called "a perfect Venice," and other towns as well as plantations were under water.[86] The St. Francis levee was cut near Caruthersville, and the Memphis paper noted that Arkansas had been made into the private playground of the Mississippi.[87] The unprotected banks from West Memphis to Helena demonstrated the urgent need for federal assistance in that area.

Throughout March, crevasse followed crevasse. Levee guards killed a man found tampering with the levee near Friars Point, and again "no embarrassing questions" were asked of the guards.[88]

By April 12, over 15,800 square *miles* of land in the lower valley was under water,[89] with an aggregate financial loss of approximately $13,500,000. Out of this disaster one interesting fact stood out above all others; no levee constructed by the U. S. engineers had broken.[90] The lesson was clear. More federal control and participation could make for a more secure levee system.

Once again there was an amassing of public pressure for national levee appropriations, but navigation still ruled the roost. Some people believe that there was one answer for both navigation and flood control. One such person was Colonel James B. Miles of Helena, Arkansas, a self-proclaimed "Sage of the Mississippi River." Colonel Miles was certain that the total answer was wrapped up in the straightening of the Mississippi. By cutting through the great bends in the Mississippi the water would drain from the flooded area more quickly, thus alleviating flood conditions, and the increased flow of water would tend to scour a deeper channel in support of navigation.[91]

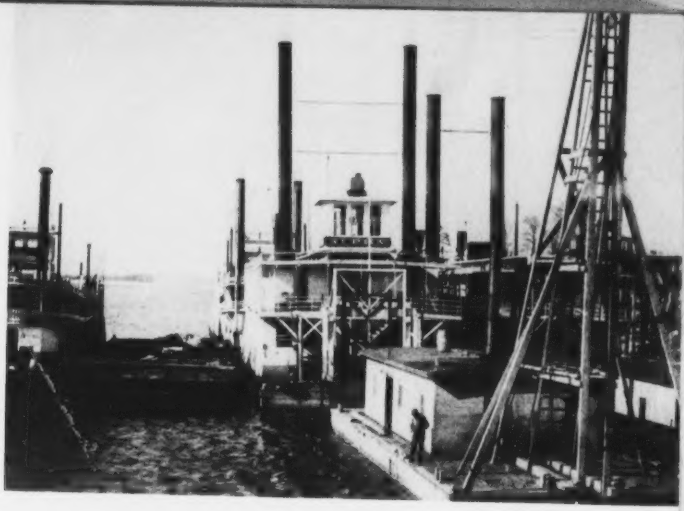
The cut-off idea was an old idea, as old as nature itself, but opinion regarding cut-offs varied greatly among river engineers. Though some early reports had recommended artificial cut-offs, most engineers believed they would not be practical. The advantages, as stated, would have to be weighed against the disadvantages of a change in river slope, increased current, and decreased water level even in low water periods. The latter factor was particularly disturbing, because it was often necessary to resort to dredging to maintain a minimum channel, and navigation was the first concern of the nation. Because cut-offs, either man made or natural, would decrease the water level, the engineers followed a policy of preventing those cut-offs whenever possible. At Ashbrook Neck and other threatened areas, thousands of feet of revetment were installed to prevent flow across the neck of land.[92]

The flood of 1897 did cause a flurry of activity and investigation of the River. The Subcommittee of the Committee on Commerce, of the U. S. Senate, toured the disaster area, listened to various levee boards and concerned parties, and made recommendations. To the surprise of no one they noted that the levees were in disrepair, and that localism was a debilitating factor. A. S. Caldwell, appearing before the subcommittee, expressed a growing opinion when he said that the U. S. had to "take hold" of the levee program to free it of local jealousies, strifes, and "questions of all kinds."[93]

Among the many novel (and unaccepted) ideas proposed by the Senators was the construction of seven or eight parallel levees, placed at right angles to the Mississippi River, and the river bank all the way across the St. Francis Basin to Crowley's Ridge. The idea, which was not unsound in itself, was that flood waters would be temporarily impounded between the levees, and then released as the waters subsided.[94]

But when the subcommittee made its report in December of 1898, they simply endorsed the existing concept of levees to "improve" the rivers, and recommended the expenditure of $18-20 million in levees over the next four years.[95]

Following the report, the U. S. made its first levee expenditure in the upper St. Francis District. Fragmented levees were joined and raised over the next several years



Part of the U.S. Dredge Fleet in winter quarters at West Memphis, Dec. 1898.

until the levee line had reached a length of 87 miles.[96]

The quick and easy victory of the United States in the Spanish-American war of 1898 restored confidence to the government, engendered a new "Era of Good Feelings," and loosened Congressional purse strings for internal improvements. Some experiments were resumed in the Plum Point reach and other areas, particularly Point Pleasant, Missouri. Point Pleasant, about twelve miles below New Madrid, was the scene of several rapidly forming bars and towheads, with subsequent division of the channel. Dikes, including the abattis type, were constructed to shut off secondary chutes, but with only partial success.[97]

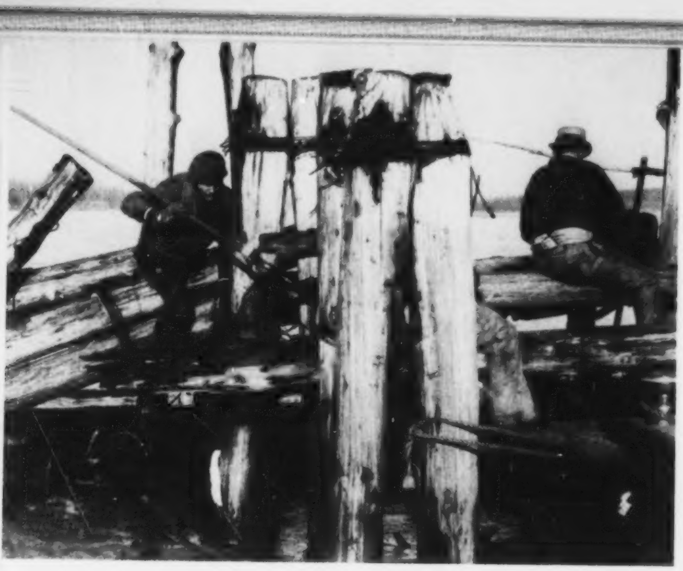
At Plum Point, efforts to close the troublesome Gold Dust Chute were marked by frustration. The engineers began to speculate that a gap in the chute should be left as a spillway. By 1890, it was ruefully admitted that more water flowed through Gold Dust Chute than had flowed through in 1893.[98] On the other hand, a secondary chute at Cherokee Crossing, about 90 miles below Cairo, was closed with complete success.[99]

Another successful project of 1899 was an immense protective levee constructed to keep the River out of Helena. Called a "regular young mountain, as solid as the pyramids," the levee was raised, broadened and strengthened to be three feet higher than any previously known flood stage. At the time, the levee was the biggest piece of levee work on the whole Mississippi River, and was particularly strong because of its composition. The mass of the levee was constructed of "buckshot," river dirt which had a clay-like consistency that, when wet, caused it to become more compact and sticky. It did not cave off or erode, and was highly desired as levee material.[100]

The year 1899 would have witnessed more improvement work in the Districts except for the reoccurence of Yellow Fever. Work was severely curtailed in the upper Districts and almost entirely suspended in the lower.[101] However, even with the impediment of Yellow Fever, the MRC reported that over ten million yards of levee material had been placed. Significantly, the MRC announced that it believed "fully" in the levee system.[102]

After the fever subsided, great gaps in the levee systems along both the Mississippi and the St. Francis were plugged. By this time, all of Memphis harbor – except about 800 feet near the bridge – was revetted, but the closing of the levee across the River threatened to create bad harbor conditions in high water.[103] The MRC decided against further work on Memphis harbor, at least for the time, and including a halt to any additional attempts to remove the bar now steadily growing in front of the city.[104] The MRC did continue revetment work at Columbus, Kentucky, and New Madrid and Caruthersville, Missouri.[105]

In 1900, Senator Burton (Ohio), Chairman of the Committee on Rivers and Harbors, directed that the MRC restudy the River and prepare a comprehensive plan for a levee



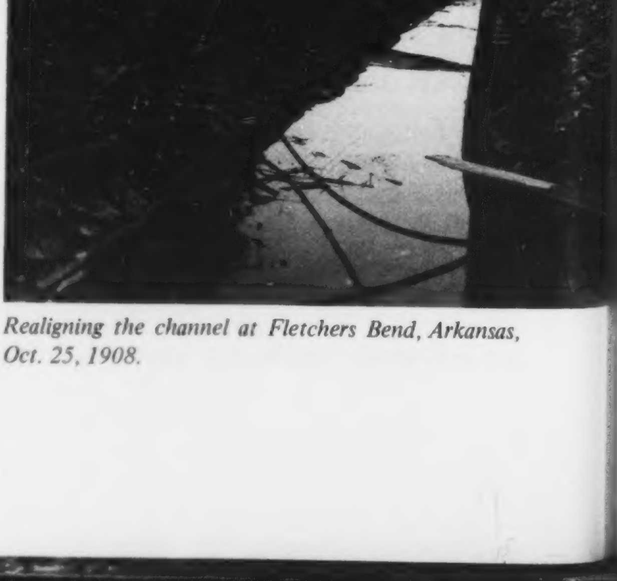
In the aftermath of highwater some pile dikes are beyond repair, necessitating their removal through the use of explosives.

system reaching from Cairo to the Gulf. The cost of the system would be jointly borne by the federal government and the several states bordering on the River.[106] The MRC gratefully accepted the charge, along with the $2,250,000 appropriation.[107]

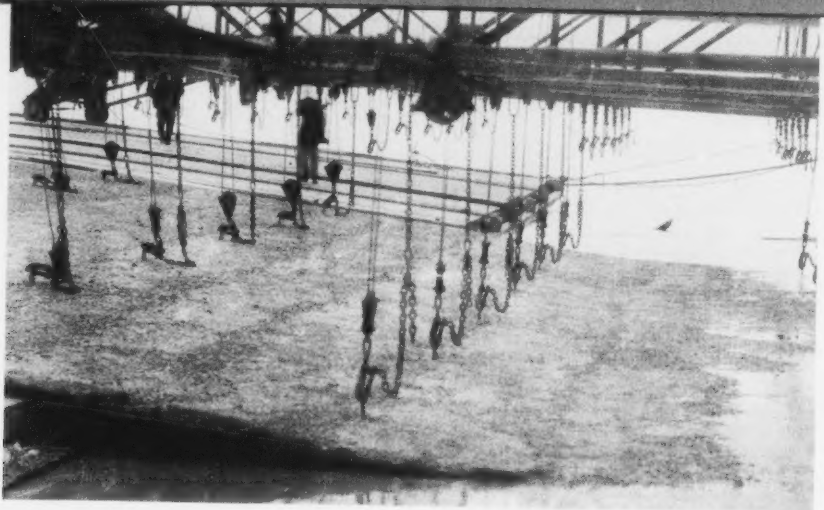
The citizens of Memphis were also seeking more governmental aid in keeping their harbor open. By the turn of the century, Hopefield Point had disappeared and much of it was deposited on the rapidly growing bar. By this time, the bar was 3,000 feet in width and extended 1,800 feet out into the River. After listening to a delegation of Memphis citizens, the MRC in 1900 decided to heed their plea and to revet the sandbar, thus making it permanent and enabling the city to use it as part of the harbor.[108] During the next several years the island increased both in length and in height. With each high water, the deposits of Hopefield Bend left as much as two and one half feet of additional topsoil.[109] Few Memphis citizens, however, could view the scrubby island as an asset.

In the early 20th century, several new Levee Districts were created as the older ones seemed to be in sight of their goal. The Reelfoot Levee District and the Upper Yazoo Levee District would make their demands on the government, but initially they had to depend upon the resources of the local citizens.[110]

In a continuing effort to find better material for revetting and ballasting, the MRC found that concrete ballast was cheaper than stone, and even more effective. In 1900, the Districts experimented with Board mattresses, fastened together by steel and copper nails, but the attempt was considered a failure. About 1907, the MRC tried another lumber



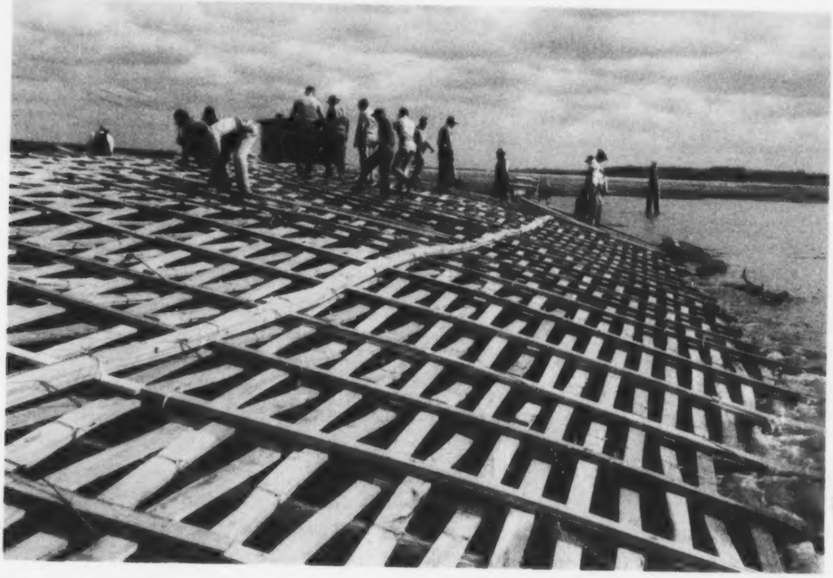
Realigning the channel at Fletchers Bend, Arkansas, Oct. 25, 1908.



A short-lived experiment in the use of huge cinder slabs as revetment material. 1916.

fascine mattress, this time using more narrow lumber, but again the results were negative. The MRC was determined, however, and the search for something better than willow brush continued. In 1909, they seemed to have reached a breakthrough. The First and Second Districts laid concrete slab revetment with positive success, although not without problems. Despite the fact that the concrete slab revetments sometimes failed through undermining and flanking, the slabs did offer the best hope of success, and further experimentation offered hope of a practical application.[111]

The First and Second Districts continued in that name although they had been consolidated since 1890. One fact under constant change, however, was the location of the administrative office. The Memphis office was moved from one place to another as though the government had failed to pay the rent. Upon consolidation, the office was located at 282 Main Street, but one year later it was removed to 280 Front Street. In 1891, the office was moved to the Appeal Building, at 235 Main Street, but, in 1893, a new location was found at 99 Madison Avenue. From 1898 to 1901 the offices were relocated to the Equitable Building, at 36-40 Main Street, and, in 1901, the office was moved to 280 Front



The lumber mattress was a variation of the traditional willow fascine mattress, but was even more prone to failure.

U. S. Postoffice and Custom House, Front Stre Memphis. Location of U. S. Engineer Office fro 1904 to 1923.

Street, the same location it had occupied eleven years earlier. The game of relocation roulette picked up speed with one move per year from 1903 to 1905, moving the Second Street address to the Randolph Building, at Beale and Main, and to the Custom House on Front Street. There at last, with a sigh of relief, the bags were unpacked until 1923.[112]

The headquarters of the MRC proved to be considerably less mobile, although they were under constant pressure to relocate to a site more central to their work. From the time of its creation, the MRC had made St. Louis its headquarters, but, in February of 1901, Congress amended the Act which had created the MRC, authorizing that body to locate its headquarters "at some city or town on the Mississippi River," and requiring it to hold its meetings at that location except when on a river inspection trip.[113] Immediately after the change in the Act, several river towns and cities began lobbying for the MRC headquarters. Memphis seemed to have had the advantage, being a large centrally located city, with an aggressive and progressive city administration. Also, there was the fact that Memphis was already the headquarters of the consolidated First and Second District, and the Headquarters of the Third District as well.[114] The MRC, however, upon consideration of all factors, decided to keep their headquarters in St. Louis, and there it remained until December of 1929. At that time, there was a general reorganization and, as part of that reorganization, MRC headquarters were relocated to Vicksburg, Mississippi, where it remains to this day.[115]

Two new dredges were added to the MRC fleet in 1901, bringing the total to nine.[116] These great dredges did a magnificent job of removing sediment from channel bottoms, clearing sandbars that threatened to divert waters through secondary chutes, and opening experimental cuts.

The new and strengthened levees may have created some complacency along the river, but that complacency was shattered by another major flood. In February of 1903, heavy rains, followed, by a succession of storms, precipitated a flood lasting 94 days.[117]

The 1903 flood fight has been called the "most extensive and persistent ever attempted in the history of levee engineering."[118] Once again, thousands of square miles of bottom lands were flooded on both sides of the Mississippi. Towns were inundated and crops and livestock, as well as wildlife, were destroyed. Even so secure a place as Memphis suffered water damage, as the Wolf River and Bayou Gayoso were backed out of their banks. The new Reelfoot levee, only partially completed, was destroyed. Crittenden and Lee Counties in Arkansas were under water, and crevasses were occurring regularly along both the Mississippi and the St. Francis. All in all it seemed that the First and Second Districts would suffer an all-time disaster as the River at Memphis climbed to its highest stage ever recorded. However, the damage was not as great as that flood stage would seem to indicate. Crevasses were less numerous and less extensive than in the last major flood, and the engineers proudly noted that the levee system, even in its incomplete state, had served the valley well.[119]

Encouraged by the minimized losses, the Districts went to work on levee repair with renewed determination. The flood, as always, had served to point out levee deficiencies, and

U.S.
DREDGE
KAPPA.
M.R.C.

The suction dredge "Kappa" served the District for the first quarter of the century.

the engineers attacked those deficiences. Once such point was a three mile section of levee reaching from Bradley's to mile 146. In that stretch, the water had lapped to the top of the levee, and only sandbag reinforcements had prevented a crevasse.[120]

By that time, the levee system was reaching formidable proportions, as older levees had been raised and broadened and strengthened again and again. The MRC reported that some $57,000,000 had been expended to place 1,500 miles of levees containing 174 million cubic yards of material.[121] But even so, the job was not yet complete and the burden still rested largely on the shoulders of the local citizens. After 1904, however, the systematic maintenance of levees received more attention by the MRC, and a real plateau was reached in 1906 when the MRC's authority was enlarged to include the construction of levees.[122] Furthermore, the Districts entered into a new practice of building revetments to protect levees. Attention to levees was rapidly catching up to river navigation as fundamental to MRC thinking.[123]

In early 1905, it was announced that the St. Francis levee system was complete. The "last shovel of dirt" was placed near Cat Island on December 30, 1904, and future work would consist of adding height to the existing levees.[124]

Snagging and dredging were the bread-and-butter activity of the Districts from approximately September to November of each year, when the water was normally low. During this busy season, the dredge fleet moved from 2-5 million cubic yards of sand,[125] while at the same time a forest of snags were being removed from the channel. These activities brought hundreds of letters of grateful acknowledgements from shipping interests and businessmen became determined that the River would not only be maintained but improved. In 1906, the Great Lakes and Gulf Deep Waterways Association called upon the engineers to create and fix a deep channel from Chicago to the Passes.[126] At the same time, thousands of people attended the National Rivers and Harbors Congress in Washington and other river interests combined in many river conventions.[126] Their common bond was a plea for even more government aid and support to river control, but the concept of a deep channel from Chicago to the mouth of the Mississippi was the plan most often promoted. In 1907, the MRC was hounded by a group called the "Fourteen-foot Deep Channel Waterway Board," and President Theodore Roosevelt, in his Annual Message to Congress, went on record as favoring a deep waterway from "the Great Lakes to the Mouth of the Mississippi." As further evidence of his interest, he appointed an Inland Waterways Commission to study the major river systems, and personally accompanied the Commission on their tour down the Mississippi. Before he left office he ordered that the Inland Waterways Commission be made permanent.[127]

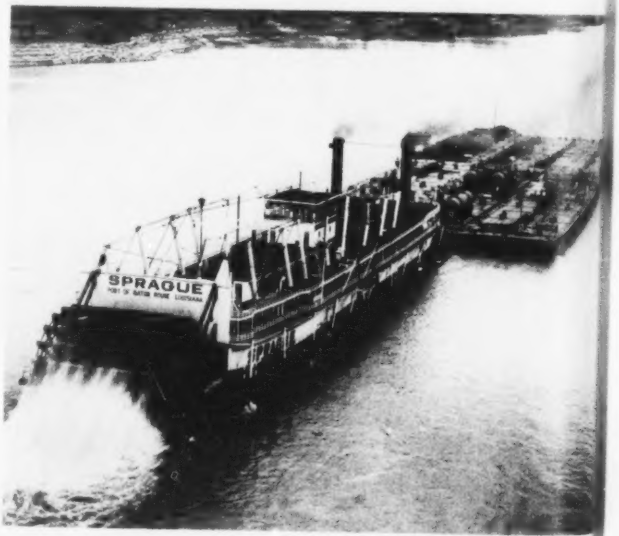
A minor flood in 1907 caused more damage to Memphis than anywhere else. As the river began to rise in January, north Memphis flooded and 2,000 barrels of mash were set afloat in a distillery.[128] Continuing rains and rising water caused a part of the bluffs between Beale Street and Linden Avenue to collapse with a thunderous roar.

President Taft and his party arrive at Natchez Landing, Mississippi on inspection tour. 1909.

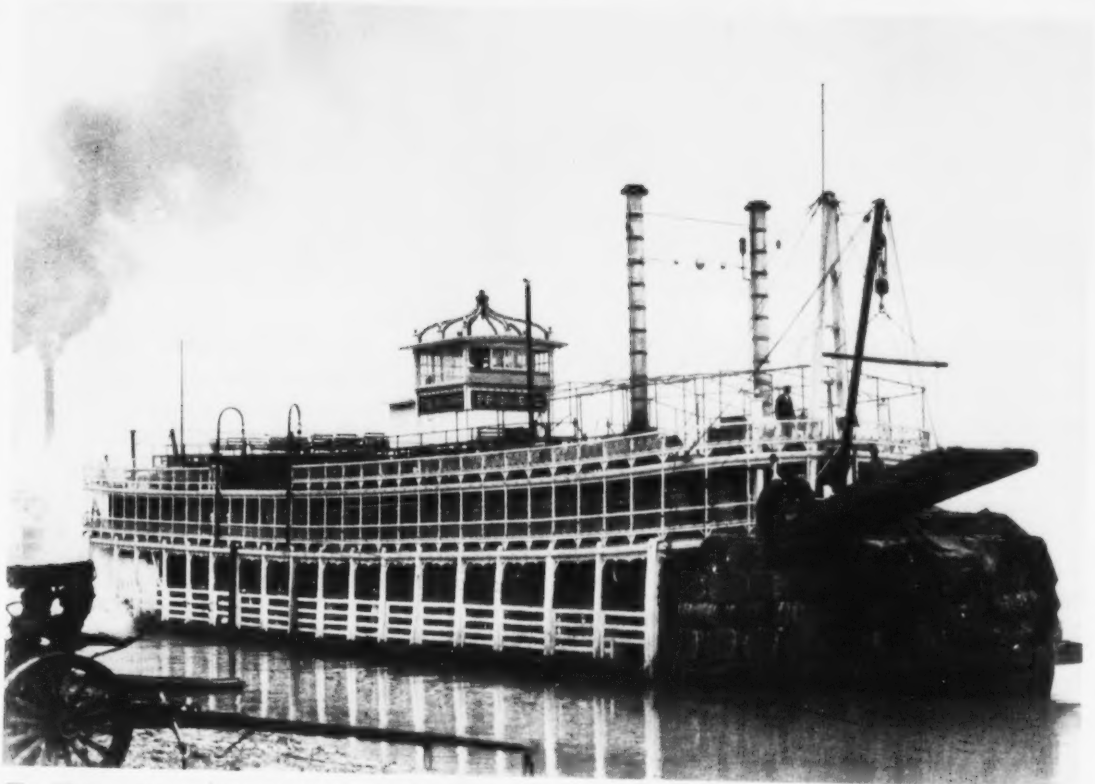
When the large section of land fell into the water it caused a tidal wave that "almost" wrecked steamboats as far as a half mile upstream.[129] The slide also contributed to the harbor problem. Mud Island was continuing to develop, and the north end of the channel between the bar (island) and the mainland was being filled in by the sediment of the Wolf River. Saw mills, located on the Wolf River, customarily dumped their saw dust into the river, and the engineers found that 20% of the material dumped by the Wolf River was saw dust. Through court action the mills were forced to stop their dumping practice, and this alleviated the situation somewhat.[130] Dredging could have solved the remainder of the problem, of course, and some dredging was done, but the dredge fleet was being stretched to capacity. The same troublesome areas usually required periodic dredging, and some areas, such as Point Pleasant reach, required annual dredging. There were more bars and reaches above Memphis requiring dredging than below Memphis, but it was a full reach project.[131]

The advocates of the fourteen foot channel knew not what they asked, but they were organized and persistent. As early as 1908, President Roosevelt's Secretary of War, William Howard Taft, asked Congress to authorize the 14 foot channel. Despite the fact that the request has been turned down many times since then, the demand for the 14-foot channel is still being promoted.[132]

Record tows were established with almost each passing year. The *Sprague*, the largest paddle-wheel towboat ever built to that time, set two consecutive records in 1907 and in 1908. In 1907, the *Sprague* transported a tow of 60 barges of coal, covering an area of six and one-half acres. In 1908, the *Sprague* transported another huge tow of barges, this one with a width of 361 feet and a length of 1,160 feet.[133] Both were record tows and they tended to refute the contention that railroads were destroying river commerce. But, in truth, the railroads *were* cutting into river traffic. The Inland Waterways Commission even while recommending a deep-water channel in its 1908 Report, noted that commerce was being driven from the Mississippi by the railroads.[134] President Taft, who had succeeded his sponsor,

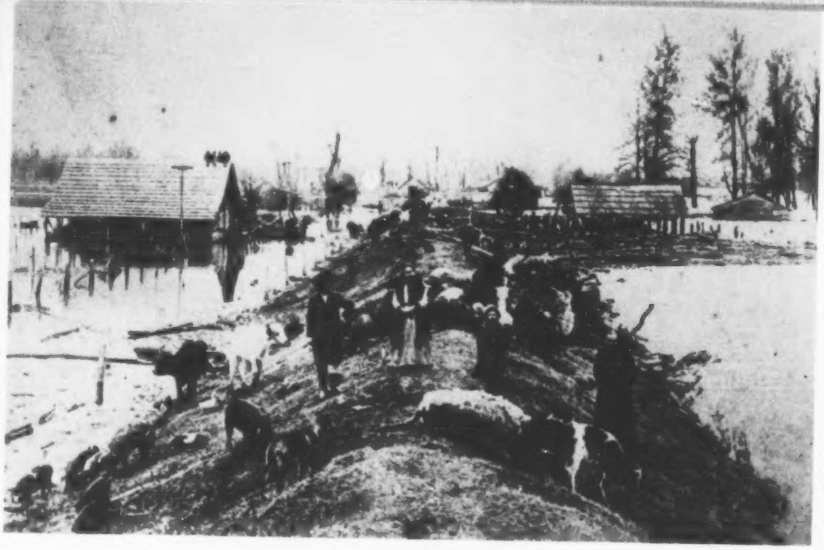


The great and near-legendary "Sprague," heading down-river with an unusually small tow. It was said that the great paddlewheel contained enough wood to make at least four five-room houses.



The "Princess" was designed to be a passenger ship, but the owners converted it to a cotton ship with the decline in the passenger trade. Note the bales stacked protectively in the promenades.

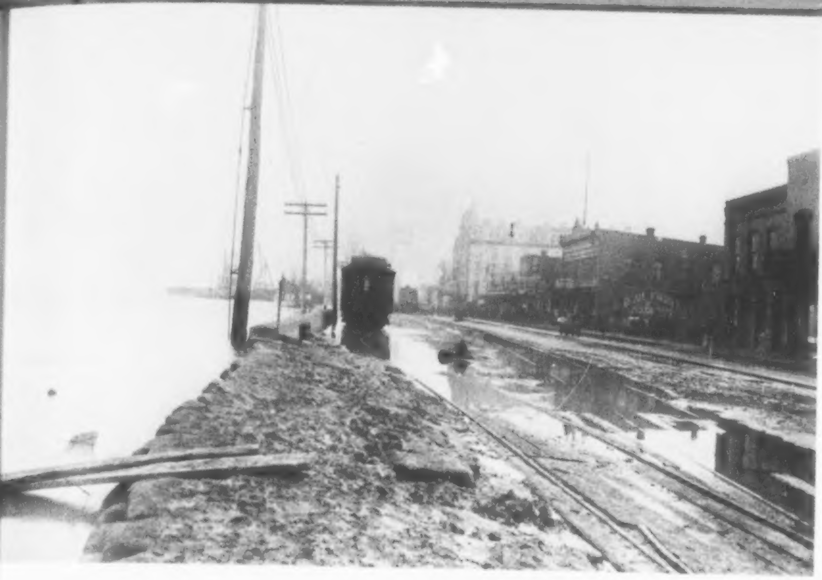
The crew members of the Steamer "Choctaw," dressed in their Sunday clothes for this formal picture, 1907.



1912 Flood, near Hickman, Kentucky. The misery of man and animal is evident, even as the flood waters are in recession.

Theodore Roosevelt, and who had hitherto been a promoter of an improved river system, seemed to ring the bell on river commerce in 1910. In an address to the annual River and Harbor Convention, he told them that – because of the railroads – river navigation was "no longer of major importance." He then went on to soften the blow somewhat by suggesting that the river people "join hands" with the railroads for better transportation.[135] In line with the President's thinking, the MRC allotments for the next two years were rather small in relation to the work that needed to be done. The reduction in river funds seemed to stir latent river sentiment, however, and the Lakes-to-the-Gulf Deep Waterway Association increased their demands to an 18 foot channel.[136] The effort was clearly futile as, in 1912, Congress appropriated less money for River and Harbors than at any time since the depression year of 1894.[137] Because of the reduction in funds, the engineers had to announce a policy of temporarily abandoning the protection of levees by revetment, and to make maximum use of their resources in the prevention of natural cut-offs, such as the one which was threatening at Sun-Flower.[138]

The short-sighted national policy regarding flood control was brought up sharply by two consecutive and disastrous flood years. In 1912, the crest exceeded all prior records at all gages south of Cairo. Twelve crevasses took out fourteen miles of levees,[139] and 10,812 square miles of land was inundated. The only note of encouragement came from the announcement that the levees had saved as much property as had been destroyed by the ruptures.[140] Memphis became the temporary home to over 19,000 flood refugees and the editor of the Commercial Appeal angrily demanded that the government appropriate $100 million to build levees if that much would be required.[141] President Taft, although still dubious about the future of river commerce, asked Congress for an immediate appropriation of $1½ million to repair breaks in the levee system. Congress granted the request within 24 hours, and included an additional $700,000 for relief of flood victims. Furthermore, when the River and Harbor Bill came before Congress in that year, they appropriated $8 million more than requested while stipulating that $4 million be used in levee construction.[142] The Flood of 1912 caused such an about-face in national thinking that, when the Presidential nominating conventions were held later in the year, all three parties including Teddy Roosevelt's Progressive or "Bull Moose" Party incorporated flood-control in their party platforms.[143] When Woodrow Wilson was nominated by the Democrats, he made it clear in his acceptance speech that the federal government should and would build and maintain levees for flood control. Thus it was that the reversal of national attitudes was complete, and whereas flood control had been



Cairo, Illinois, in an altogether too familiar predicament. On April 2, 1912, the water is beginning to soak through the stone wall at Fourth and Ohio Levee, and the tracks are already partly submerged. The view is on the Ohio levee front, looking south. The buildings are: old Hotel; famous Blue Front Restaurant; Pat Scullen Restaurant; Warwick Saloon; the I.C.R.R. Station. The large white building below the station is the Halliday Hotel and in the distant background can be seen the shape of the Halliday elevator and the south end of the old levee wall.

considered a private problem in the 19th century, it was now considered a national priority.[143]

The various state levee boards, in a state of high elation, responded by voting even more funds for levee work[144] and it appeared that a new era in levee building was at hand. Representative K. D. McKellar, of Memphis, demanded that the MRC move from its remote location in St. Louis into the area under its control but was countered by Representative Ben G. Humphreys of Greenville, Mississippi. Mr. Humphreys defended the responsiveness and integrity of the MRC and felt that they could act more impartially from St. Louis. Humphreys then went on to co-sponsor a bill, with Ransdell of Louisiana, that would have provided $80 million for "permanent" levees on the Mississippi. Of that amount the States would have been required to raise but $20 million.[145]

Before the 1912 flood damage repairs had been completed, the valley was hit by the Great Flood of 1913. Even higher flood stages were reached between Cairo and Helena. Coming in two crests, one in January and other in April, the flood added to the 1912 destruction of the levee system. At Memphis, Major E. M. Markham began an intensive effort to raise the levees to a height that would withstand a 46 foot stage there, and employed 300 teams (mules and scrapers) to raise the levees in the Lower St. Francis District. The State of Arkansas ordered convict labor into the area to help in the flood fight, and, at Columbus, Kentucky, free Negro labor was kept at work under gun point until March 31, when the levee crevassed in

A boatman's view of a rivertown in 1912. Natchez landing.

several places and the town was inundated with 5 to 10 feet of water.[146]

The *New York Times* reported that at Birds Point a levee gave way and actually floated down the river with 38 National Guard workers "on board."[147]

At Hickman, Kentucky, levee crevasses poured 14 feet of water into the town, and even in Memphis the situation was becoming citical. Some abandoned buildings were being shored up as flood walls, but, despite all efforts, the northern part of the city went under.[148]

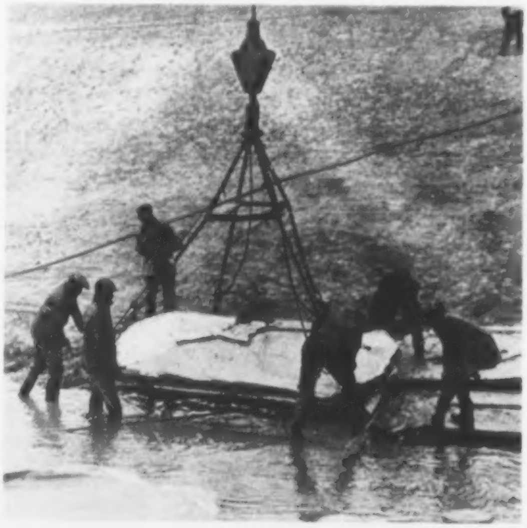
Laconia Circle, noted for its susceptibility to floods, again crevassed, as did the levee at Golden Lake. Poinsett, Cross and Crittenden counties were flooded to a depth of several feet, and the whole of the lower St. Francis District was in flood distress. Every area of the Districts suffered flood damage before the flood crested on April 9, 1913, with a gage reading of 46.1 feet at Memphis.[149]

As with all of the major floods, the Flood of 1913 demonstrated both the value of good levees and the fallacy of incomplete levee systems. Of the levees under the control of the Memphis Office, there were crevasses totaling 20,000 feet which caused flooding to a 2,105 square mile area. This amounted to about 24% of the entire protected area.[150] The need to raise and reinforce the levees was obvious.

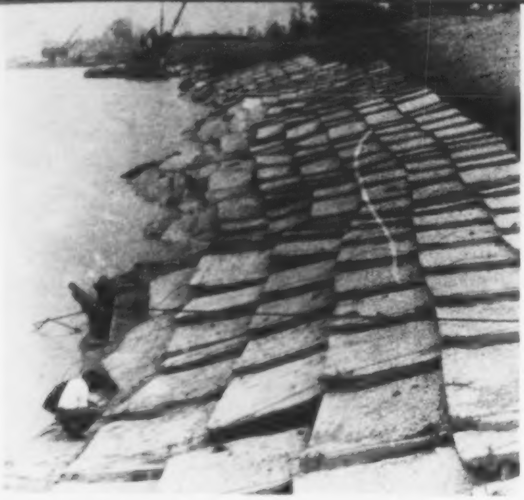
Two immediate effects of the floods of 1912 and 1913 were (1) to precipitate a search for better levee equipment (mechanical), and (2) to add urgency to the search for a revetment material that could better withstand the ravages of water. In 1913, the MRC directed the District officers to make a search for "suitable mechanical appliances," or to develop those devices that would aid in fast and efficient construction of levees.[151]

As early as January of 1914, Major Markham was ready to test a variation of the bucket and dragline. The new variation was a bucket that would operate from a tower constructed inside the levee.[152]

In search for improved revetment, the Districts at Memphis again experimented with concrete slabs. In 1913 the slabs were made much thinner than previously used and various dimensions of slabs were tried. Since



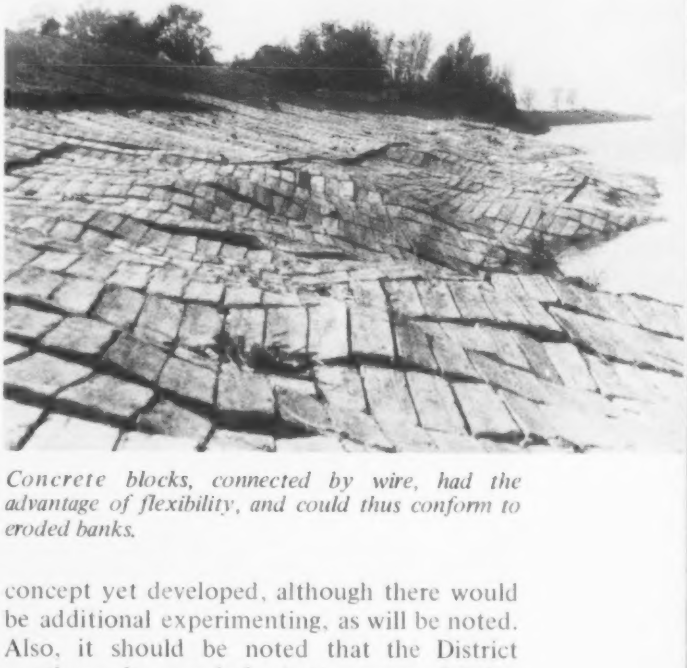
The state of pre-WWI reventment technology was that concrete slabs would be hoisted by a derrick, but would be put in place by manpower. This is a lap-slab type of revetment, being placed near Happy Valley, Arkansas.



Lap-slab paving, in place and being ,inspected. This concept was one of the more successful variations leading up to the articulated concrete mattress evolution.

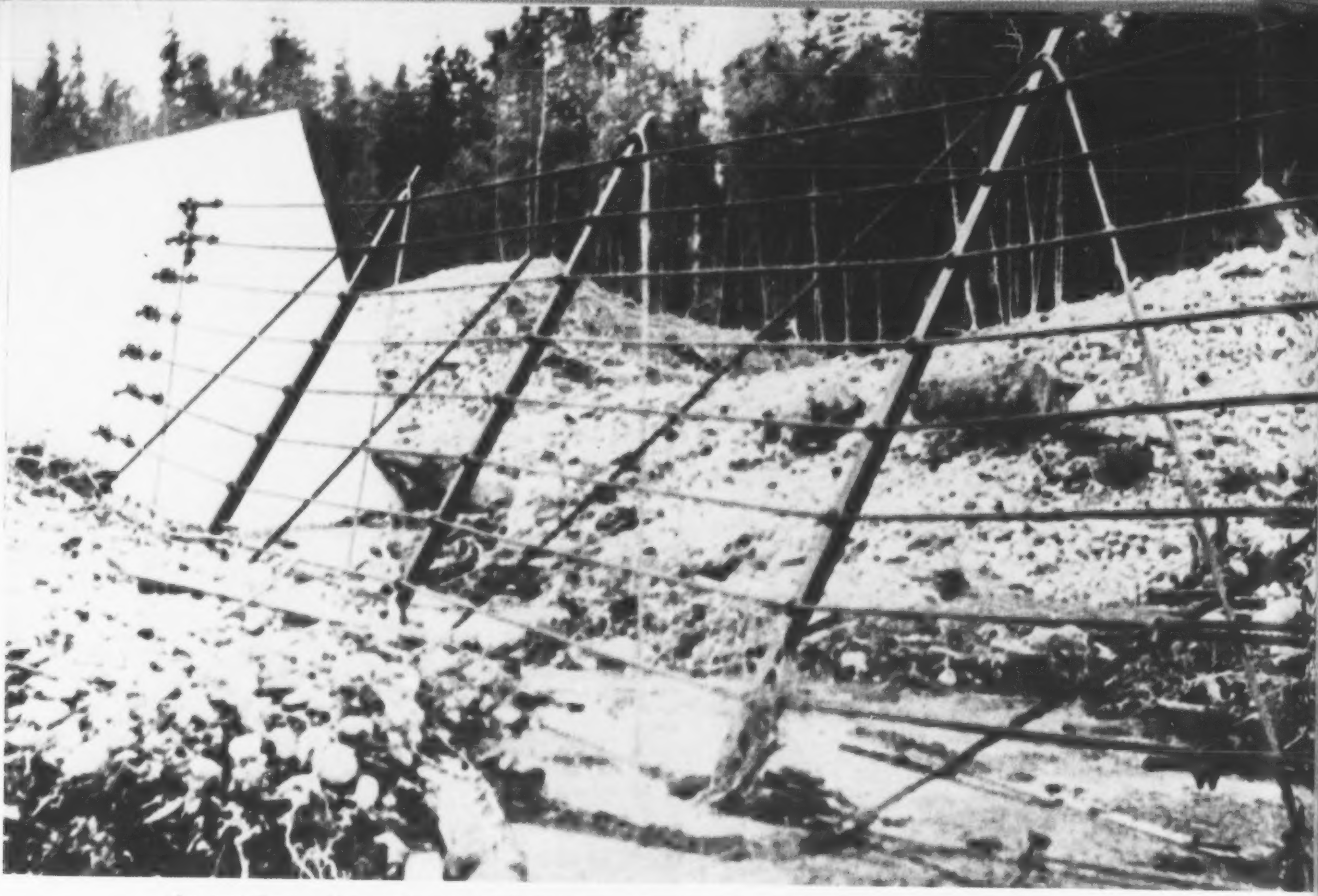
the thinner slabs cracked and conformed to the bank surface they were adjudged to be another step forward, even though not the final answer. One major impediment to the use of concrete slabs was the difficulty of handling and placing them, and, for that reason, the concrete mattress was to undergo more development before assuming its place as the standard procedure. There was even a short-lived experiment with using huge cast slabs of cinder, but cinder proved to be too erodable.

Individuals came forward with their own variations of the concrete slab, and the MRC directed Major Markham to hear them all and work with them whenever their ideas had possible merit. The MRC began to advocate experimentation with smaller slabs, including better equipment for laying the revetment. By 1915, it was generally conceded that concrete would be the new material for subaqueous revetment.[153] Developing on an idea that had been proposed in the Memphis District, the Vicksburg district came through with some solid concepts in flexible concrete mattresses, and as early as 1916 the prototype of the modern articulated concrete mattress was placed in Vicksburg Harbor. The mattress sections consisted of small concrete blocks held together by flexible wire, with sections tied to each other to form as large a protective mattress as needed. The flexibility of the mattress allowed it to conform to the irregular slope of the bank, the inherent weight eliminated the floating problem, and the durability of the concrete was superior to other practical materials.[153] This general concept proved to be the most practical concept yet developed, although there would be additional experimenting, as will be noted. Also, it should be noted that the District continues its search for better ways of doing things, so no improvement is ever considered the final improvement.



Concrete blocks, connected by wire, had the advantage of flexibility, and could thus conform to eroded banks.

The 1912 and 1913 floods were direct and final factors leading to the emergence of Mud Island as a permanent albiet unwanted, fixture before Memphis. The lower end of the island was still subject to overflow in periods



An experiment in creating semi-natural channel barriers, as an alternative to the piling or stone dikes. In this concept the cables would trap debris, and the ever-accumulating debris would create a dam which would become impervious, thus completely sealing off the chute. The experiment, tried shortly before the U.S. entry into World War I, was not as successful as other efforts.

of high water, and the citizens of Memphis held the constant hope that the whole thing would wash away during the course of a major flood, but it was not to be. Joseph H. Miller, a recently retired employee of the Memphis District, recalls that the Flood of 1913 was really the event that fixed the future of Mud Island by changing the channel of the river. High water cut through Hen and Chicken Island, dumping that additional material on the bar and raising the island's level. Before 1913, Miller recalled seeing the keel marks of steamboats as they had dragged across Mud Island in times of normal water elevations. After 1913, the Island was mostly above water at all times, and shrubs and brushes stabilized the surface.[154] Unfortunately, a second bar began to form between Mud Island and the shore.

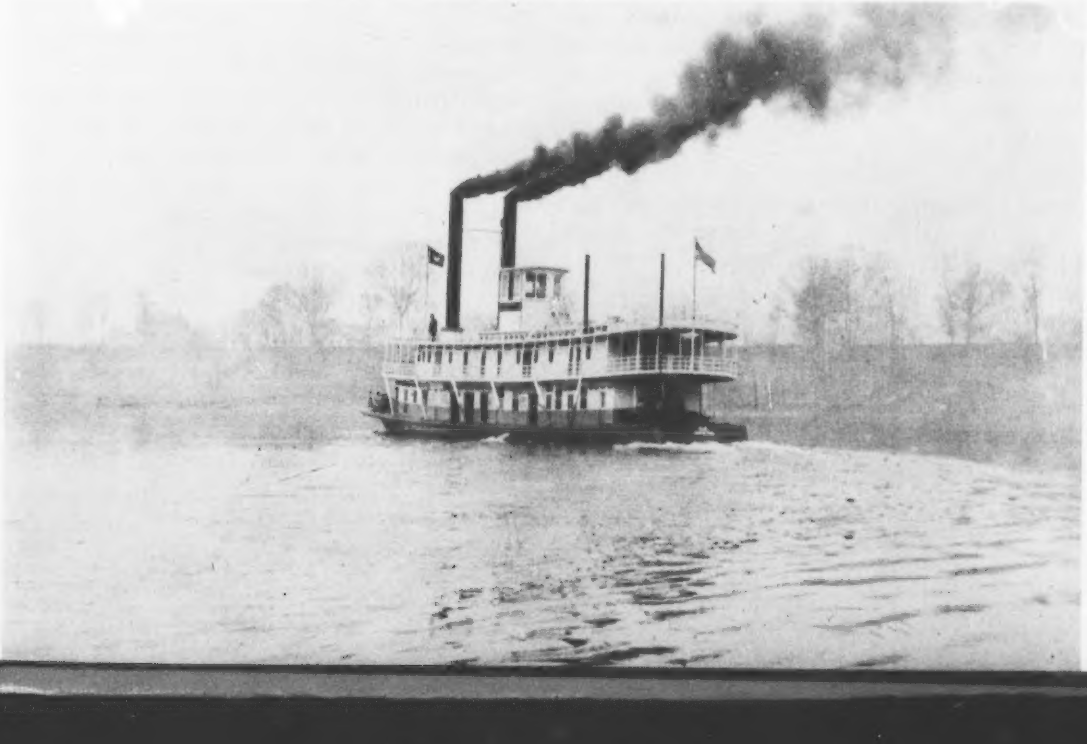
The city did not accept the situation lightly, and for the next two years the engineers, under great public pressure, tried to remove both the bar and the Island. But the Island was adamant and the dredges could not keep up with the growth of the bar. By 1915, a plan was taking shape whereby the waters of the Loosahatchie and the Wolf Rivers would be diverted through the channel between Mud Island and the city, thus scouring out the area and at last removing the offending bar. The rechannelling took place in 1916, and a channel of 3,000 feet was established between Mud Island and the city.[155] The advantage was to the city, for the new channel kept the Memphis harbor scoured neatly, and Mud Island protected the city from errant waters and occasional ice flows. The 1920 census showed 25 people living on Mud Island.[156]

The city of Memphis benefited greatly from the new channel the Mississippi had chosen. No longer did the waters bore in off Hopefield Bend, carrying both sediment and danger to the city. This new channel slipped smoothly by the city rather than attacking it.

Between 1915-1917, the focus of national attention was fixed on international affairs. The war in Europe was channeled to American attention via the infamous U-Boats, and American involvement was becoming less of an improbability. The Ransdell-Humphreys Bill, which had been viewed so favorably at one time, ran into stiff opposition and was abandoned in 1914.[157] By way of compensation, the House Committee on Rivers and Harbors added only one million dollars for levees and revetment and even that small appropriation was reduced by the time it got to the President. As finally approved and signed by the President, the appropriation for the work on the Mississippi was four million dollars short of the original request.[158] This appropriation would continue to shrink in each of the next two years as the nation turned its attention to the war in Europe. Notwithstanding the national attitude, the Districts made maximum use of the funds that were allotted, and, in the period just prior to April 1917, much snagging, revetment and levee work was done on the troublesome reaches of the River.

In 1916, there was a major effort on the part of private interests to get Congress to separate the Mississippi River appropriations from the regular River and Harbor Bills, but a Congressional Bill to that effect failed to pass. Again Representative Humphreys tried to get a comprehensive levee bill passed, with the government bearing $45 million of the $65 million price tag. President Woodrow Wilson indicated that he approved, but only if it would not delay Congress in "more important" legislation, such as railroad legislation.[159] It was not the best of times for river interests.

The "Inspector" gets an early start on a long day.



CHAPTER III

Progress and Paucity

The year 1917 opened with the Corps of Engineers preparing for a two-front war. The war in Europe was raging and in only a matter of months the Corps of Engineers would be doing their share to make the world "Safe for Democracy." A war of a different type was also being conducted along the Mississippi River. On the Mississippi, the Engineers usually planned on two major battles each year with a few skirmishes in between. These battles consisted of "the battle of drought and the battle of the flood, the struggle in periods of low water being to keep the channel open so that the boats may travel, the combat in floodtime being to confine the raging waters to their banks so that they will not sweep the Valley to destruction."[1]

Ever since the major floods of 1912 and 1913, influential leaders from the Mississippi Valley had been pressing for a national flood control law. Moderate floods in 1916 and 1917 had kept the issue before the public as much as possible considering national conditions. The Mississippi River Commission pointed with pride to the fact that, although the flood of 1917 had inundated 1,734 square miles, all flooding was from backwater. There had been no crevasses in the main line levees and the still incomplete levee system had saved 25,000 square miles from overflow. According to the Commission, it was a proven fact that levees, and only levees, afforded the Valley the best protection from the murky and turbulent waters of the Mississippi.[2]

During 1915 and 1916, the Congress indicated its moderate interest in the flood problem by requesting various data about the levee system. Representative Ben Humphreys (D. Miss.), with the help of the Mississippi River Levee Association, had framed the flood control bill rejected in 1916. In 1917, the Bill was reintroduced and the Senate voted 40 to 16 for approval.[3] The House agreed to accede to minor amendments the next day, and, on March 1, 1917, the first national Flood Control Act was signed into law by a reluctant President Wilson.[4]

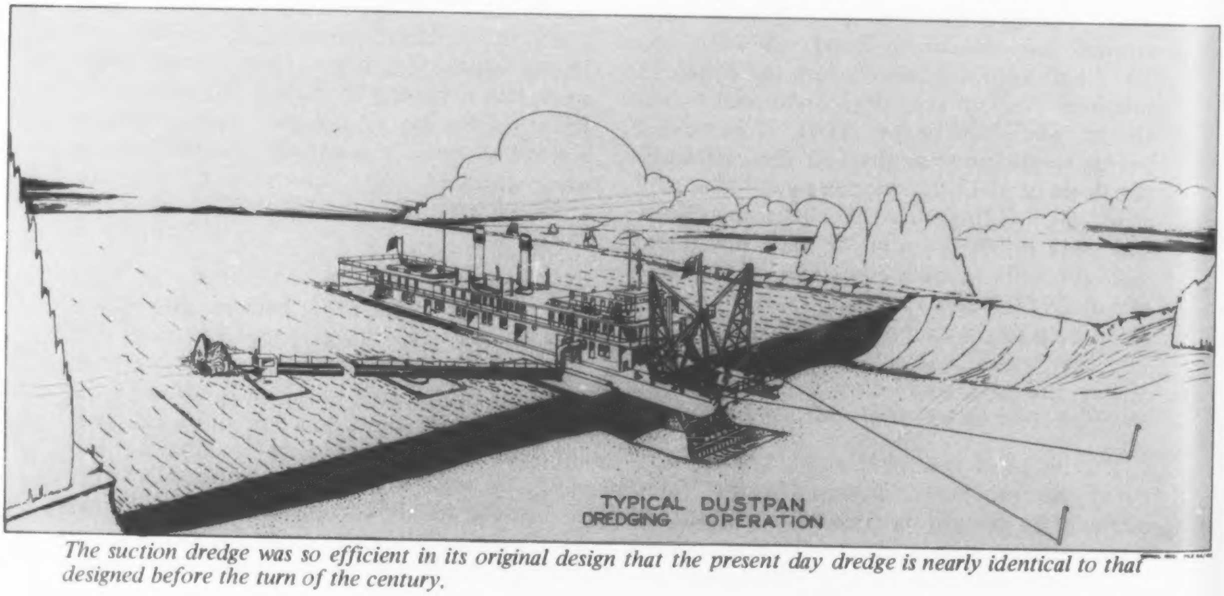
The Flood Control Act of 1917 appropriated $45 million, with not more than $10 million to be spent in any one year, and the measure contained three important provisions. First, the act authorized the construction of levees for the purpose of flood control. Second, levee construction by the Federal Government was made contingent upon local interests contributing not less than one-third of the cost of levee construction. Third, the Mississippi River Commission was authorized to expend flood control funds upon the tributary streams to protect the Upper Mississippi Basin from flood. Levee work was extended by the act to Rock Island, Illinois. Once the Commission had completed a levee section, it was to be turned over to local interests for maintenance, but the United States did not relinquish its control of the levees.[5]

With the enactment of this bill, the First and Second Engineer District resumed levee construction at an accelerated pace. In the Upper St. Francis Levee District, more than 596,000 cubic yards of dirt was added to the levees by both the Engineers and local levee interests. There were fourteen contracts either ready to begin or partially completed. At the end of the fiscal year, the levees in the Upper St. Francis District were 44.6 percent completed.[6] A loop levee was constructed in the

1922 Technology at work. Hole is being bored at base of tree stump preparatory to "blowing" the stump. Wyanoke, Arkansas. Lower St. Francis Levee District.

Reelfoot Levee District to bypass a section of the levee threatened by caving banks, but the Lower St. Francis Levee District received the bulk of the funds allotted to levee construction. During that fiscal year, the Engineers and local interests placed about three million cubic yards of material on the levees at a cost of more than $1.2 million. By the end of 1917, the system was 84 percent completed. No federal money was expended on the Upper Yazoo District, but the local levee board had made additions to the system. About 800,000 cubic yards were added to the levees in the White River District.

Revetment of the banks was also carried forward that year. About 15,000 feet of mattress was placed on the river banks, and work on procuring the necessary plant for the placement of subaqueous concrete revetment was carried on. The River and Harbor Act of 1916 had provided for such an experiment and the Commission had allotted $150,000 for the construction of one such unit. Plans and specifications for the barge and concrete mixing plant were approved and the bids invited. However, the District Engineer was concerned that the threat of war would make steel prices prohibitive and labor scarce and that this would probably delay any actual revetment work with concrete until next season.[7] Such proved to be the case.



The suction dredge was so efficient in its original design that the present day dredge is nearly identical to that designed before the turn of the century.

Dredging operations during the low-water season consisted of four dredges working on twelve crossings from the foot of Toneys Chute, 78 miles below Cairo, to Cat Island, 256 miles below Cairo. A major part of the dredging season consisted of work in the Memphis harbor. Part of the flow of the Mississippi was diverted into the Mud Island canal by way of the Loosahatchie. It was hoped that the increased scouring effect of this current would keep the harbor clear. This project did minimize the difficulties in the harbor, but dredging was still required to remove the silt deposited by Wolf River.[8]

In 1917, the Mississippi River crested at Memphis on April 10 at a stage of 40.3 feet. Normally such stages no longer presented a problem as far as the levees were concerned. Nevertheless, the Mississippi River Commission contended that every mile of the levee had to be guarded because the United States had declared war on Germany on April 6. The Commission's position was that the expense was justified even though there appeared to be little danger of sabotage to the levees. T. G. Dabney, Chief Engineer of the Upper Yazoo District, reported that the usual civilian guards would be sufficient against even an organized attempt against the levees by German sympathizers.[9] H. N. Pharr, Chief Engineer of the Lower St. Francis Levee District, placed armed guards two miles apart on the levees.[10] Both Dabney and Pharr believed that the State Militias were sufficient to meet levee threat and even though there were no attempts at sabotage, the Engineers and local interests did not relax their guard until the waters of the Mississippi had returned to the channel.

In the World War I Era, "hard times" snagging could still be likened to coal mining, with muscle and blood and skin and bones being the basic ingredients.

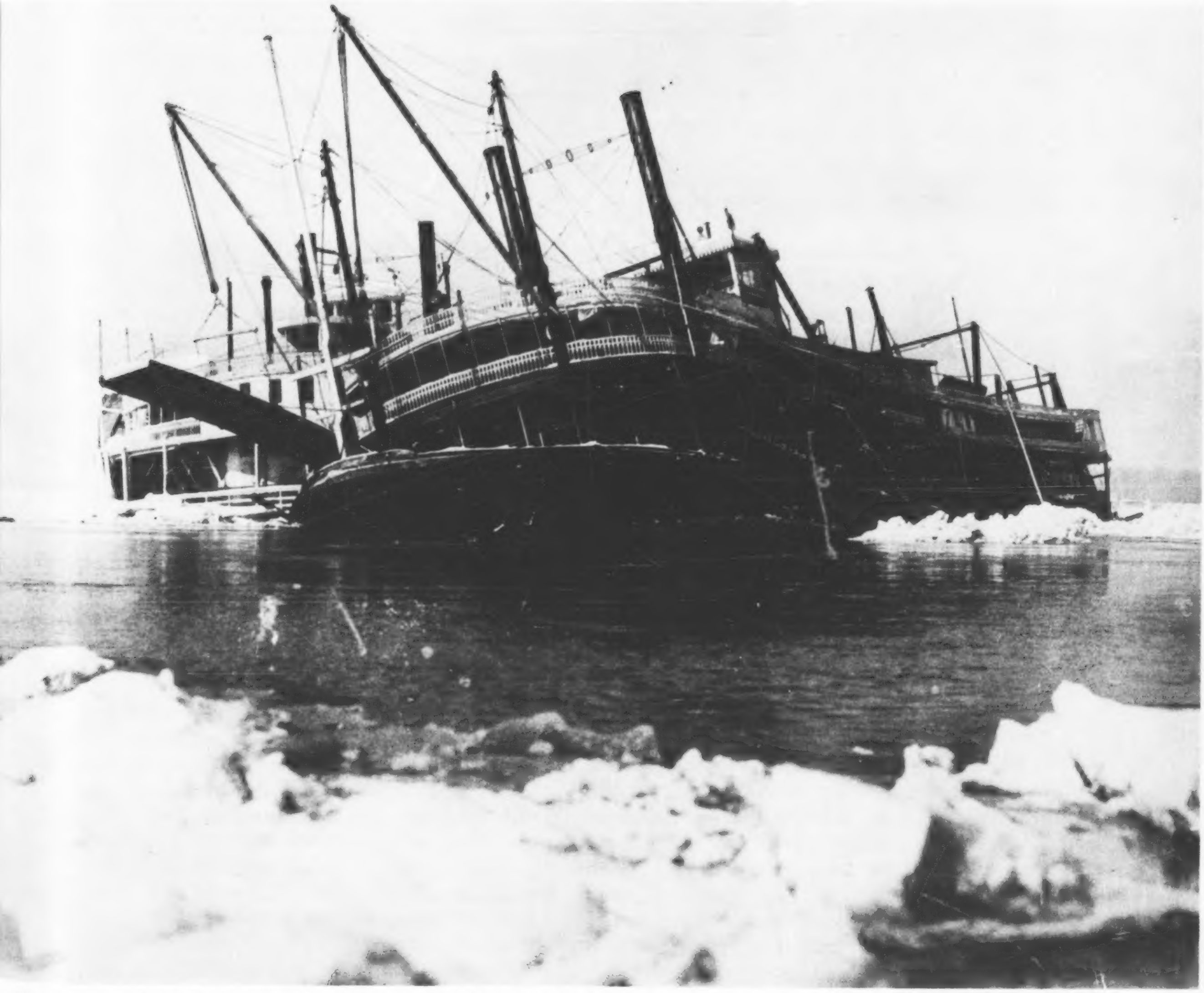
America's entry into World War I, while causing a drastic reduction in appropriations, did not halt the Engineers' work on the Lower Mississippi. Reasoning that the Mississippi was a vital link in getting war materials out of the mid-section of the nation, the Secretary of War ordered navigation and flood control work continued throughout the war. Keeping a navigable channel open was a vital part in the war effort. While singing "Over There" the Engineers would do it "Over Here" as well.

The Mississippi River Commission had come to the conclusion years earlier that dredging was the most desirable method of maintaining an adequate channel. A Dredging District under the direction of the Secretary, Mississippi River Commission, had been created in 1896 and St. Louis was designated as the headquarters. In 1898, the Commission had begun to use West Memphis as a headquarters for assembling all dredging plants during high water and all equipment was serviced at this location. A tract of land was purchased in 1903 and a general supply and repair depot constructed. Gradually, it became apparent that a more efficient operation could be maintained by a reorganization of the Dredging District.

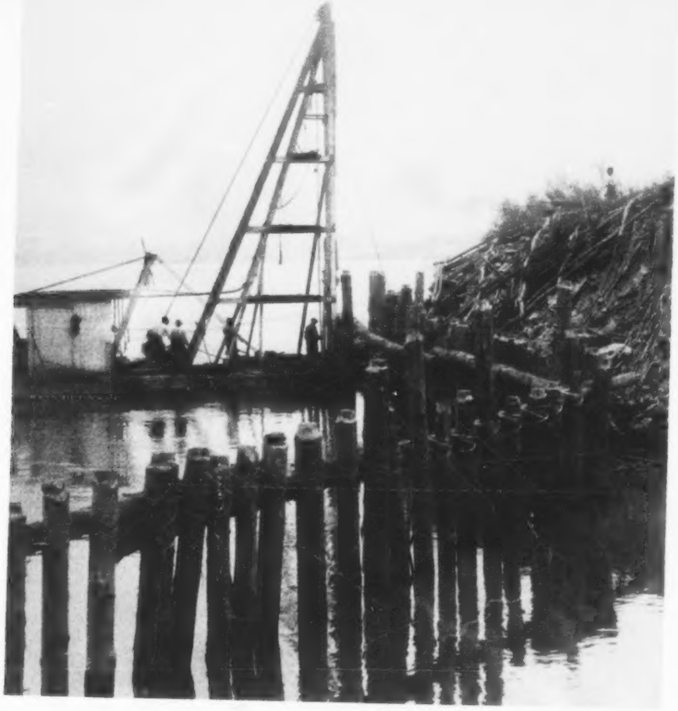
In late 1917, the Commission submitted such a plan to the Chief of Engineers and the Chief gave his approval on June 5, 1918. A new Dredging District was created on July 10, 1918, and direct supervision of dredging was transferred. Although located at West Memphis, the Dredging District had its own District Engineer and was not affiliated with the First and Second District.[11] All funds and plant pertaining to dredging were then transferred to the new District and exclusive control over dredging was exercised by this identity until 1928.

Dredging operations during the low water of 1917-1918 presented few problems. No dredging was carried out above Morrissons Crossing, seventy miles below Cairo. During this period, cold weather was the most serious problem threatening navigation. From December 9, 1917, to February 13, 1918, navigation was completely halted because of abnormal ice conditions. A gorge of broken ice extended from Columbus, Kentucky, to Cairo, a distance of twenty-one miles. For several days, similar gorges existed at Barfield, Osceola, Richardsons, and Seyppels. Above Cairo the ice was unbroken and remained for several weeks.[12] It was the worst ice jam since 1872. In that year it had been reported that, when the jam broke, blocks of ice as tall as a two-story house came floating past Memphis. In 1918, it was reported that five men managed to cross and recross the river on foot at Richardson's Landing and Weona, Arkansas, newspaper stated that wagons were able to cross the river on top of the ice.[13]

The First and Second District received a little over $1.5 million for work during 1918. Of this sum, $375,000 was allotted the Memphis harbor. This project contemplated the construction of a series of dikes and revetments in the vicinity of Robinson Crusoe Island on the west side of the channel and dredge cuts through Old Hen Island on the east side. It was designed to hasten the recession of the west shore of Old Hen Island, diverting the channel eastward so as to produce erosion of the sand bar (Mud Island)



The awesome destructiveness of river ice is encapsulated in this dramatic picture taken a few miles below Memphis in 1918.



Installing dikes at Old Hen Island near Memphis, showing pile driver at work. Note lashings on the single-line dike. 1918.

in the harbor. Construction of the dikes were begun in 1918 and completed in 1921 but there was no appreciable effect on the sand bar. When the dikes failed to erode the bar, the District Engineer brought in the heavy artillery and several hundred pounds of dynamite were used trying to blast it away. It was hoped that the dynamite would loosen the material and it would wash away. It was a futile effort. Cost of the dikes and blasting came to more than $357,000, but the sand bar remained undisturbed.[14]

The first funds, appropriated to the Engineers specifically for flood control, became available in 1918 after authorization of the Flood Control Act of 1917. Even though the Federal Government had entered the field of flood control, the first move was rather timid. Funds for levee construction in the First and Second District lagged behind those of the five levee districts under the jurisdiction of the Memphis Office and these local levee districts were to contribute not less than one-third of the cost of constructing the levees. In 1918, the five levee districts under the Memphis Office had more than $270,000 waiting for matching funds by the Mississippi River Commission.[15]

There were at least two reasons for the lag in levee construction, mostly accruing from the new standards for levee construction that were adopted after the 1913 flood. First, vast amounts of levee construction were authorized to a new grade and section. Second, by 1918, draglines and tower machines had replaced the scraper in levee construction. As a result of the development of new construction methods, the amount of levee work that could be done annually was limited more by funds than by time.

Even though the United States was engaged in a major war, no shortage of levee workers was experienced. During World War I, the Lower St. Francis Levee District freely used German war prisoners in the construction of levees. Officials of the levee district reported that they were the best labor that had ever been used in levee building. Ironically only volunteers were accepted for the work and they were paid the same wages as the other workers.[16]

Work on the plant for the placement of concrete revetment continued during 1918. In the meantime, the district reverted to full use of the fascine type of mattress. During the fiscal year of 1918, more than 11,000 linear feet of revetment was placed at nine different locations in the First and Second District. Cost of this revetment work ran to more than $700,000.

In 1919, flood control work in the First and Second District was caught in an inflationary spiral. With the ending of World War I, a great economy wave swept over the nation. Leaders in Congress demanded a cutback in spending by the Federal Government. At the same time the labor movement contributed to the "Red Scare" by demanding more wages and better working conditions. The great increase in prices of both labor and material was reported to have increased project costs over fifty percent above that of normal times. According to the Mississippi River Commission, any future appropriations had to reflect those conditions if the normal rates of improvement were to be continued.[17]

Intense lobbying pressure failed to prevent the economy axe from taking a large portion of the Commission's budget. General William M. Black, Chief of Engineers, requested $10 million for levees on the Lower Mississippi, but final appropriations for levees came to only $6,670,000. Lobbying on behalf of the River Commission, the Mississippi Levee Association pointed out that the Flood Control Act of 1917 had authorized $45 million to be spent in the following five years and that three years after its enactment, the Congress had appropriated only $18 million.[18]

Lack of funds had a telling effect on levee construction. By the end of the fiscal year 1919, the River Commission had purchased twenty of the new levee machines. Nevertheless, the amount of levee construction was less than the previous year because of budgetary limitations. The St. Francis Levee District had raised its levee tax by five cents, hoping to get a larger allotment from the Commission. In 1919, the levees of this district extended 170 miles south from the Missouri State Line, and was within four miles of the mouth of the St. Francis River and all but the southernmost thirty miles could withstand a river stage of 48 to 50 feet. Levees for the last four miles were then approved, giving additional protection to 400,000 acres of lands. By the end of FY 1919, the levees under the jurisdiction of the River Commission were 73.8 percent complete.[19]

Dredging during FY 1919 was carried on between Gayoso, 108 miles below Cairo, and Fords, 715 miles below Cairo. The dredging fleet made fifty cuts with a total length of 63,800 feet. A substantial amount of the budget of the First and Second District was devoted to the dredging of the harbor at Memphis and even though this work had corrected the conditions in the harbor, additional funds for annual dredging were required. After a threat by riverboat interests to abandon their Memphis stop, the dredge fleet was put to work cleaning out the harbor again.[20]

The dredging fleet faced a continuing battle with the river and problems during a typical dredging season went something like this: The Dredge *Henry Flad* departed from the depot across from Memphis and proceeded to a spot 171 miles below Cairo. When it arrived, the steamer *Sprague* was aground at the crossing with a tow of barges. Instead of dredging, the *Henry Flad* went to the aid of the *Sprague*. In releasing the steamer, the dredge broke its winding engine. After repairing the engine, dredging operations were started. A few days later the dredge released the steamer *Barrett* at Yankee Bar crossing. Because of the length of time involved in releasing the steamer, the crew refused to do any more work. Several days later the crew was so depleted that dredging operations were halted for ten days. Another crew was secured, but after seven days this entire crew left the dredge.[21]

Funds for revetment in the First and Second District were also a major concern. The extent of caving banks was so great when compared to the funds available that it was necessary to confine such work to areas where caving either threatened a levee or threatened to produce a cut-off. Most of the revetment work during 1919 was confined to repairs and maintenance. First and Second District revetment that year came to only a little more than 6,000 linear feet and the only new revetment placed in the Plum Point Reach was at Osceola.[22]

Traffic on the Mississippi River along the Tennessee border increased several times as a result of a new state prohibition law. Blockade runners presented no problems for the Engineers except for the interference with work on the river and it was a comical situation. Tennessee was one of the first states to pass a prohibition law, even before the Eighteenth Amendment became operative and the Mississippi River became one of the most important avenues of illegal whiskey. A typical case in point occurred on June 29, 1919. After a merry chase, revenue agents captured the blockade runner *Buffalo*, but not until the crew had run the boat into the riverbank and escaped into the woods. Revenue agents found 150 cases of Yellowstone on the boat.[23]

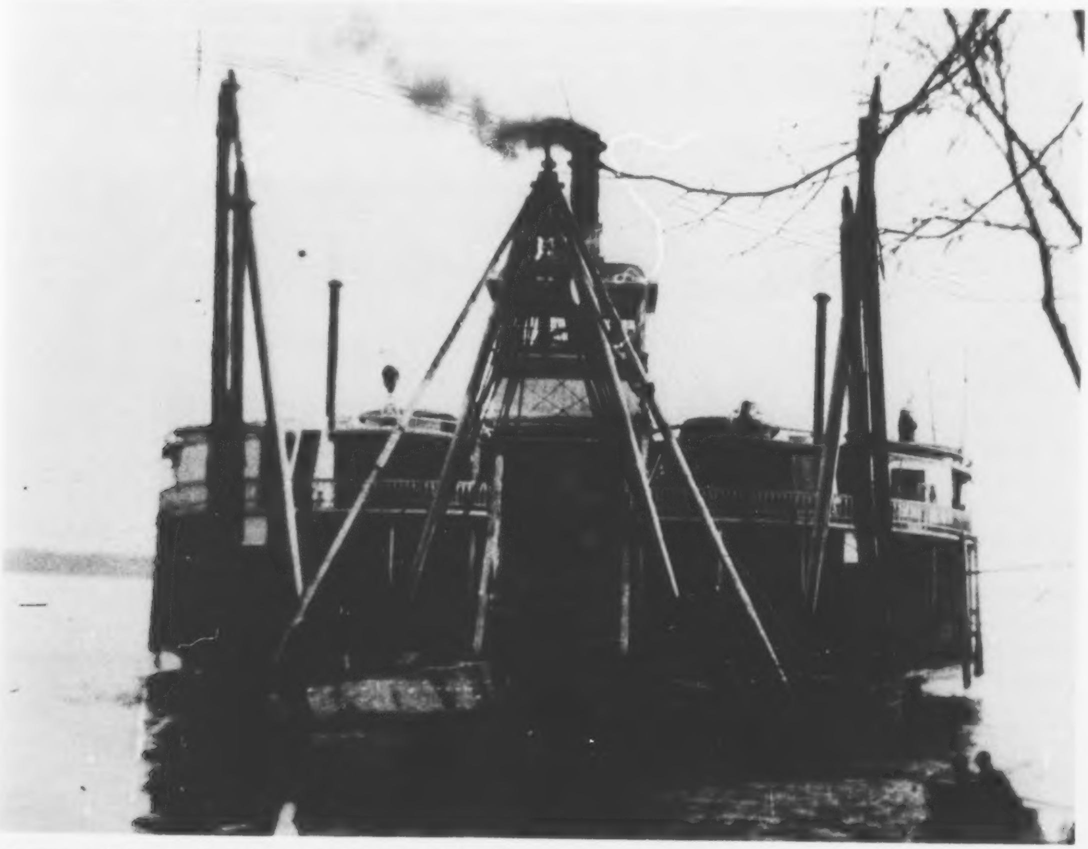
The move for economic cutbacks was still a strong force in the halls of Congress during 1920. It was a year for national elections and legislators did not want to be saddled with the charge that they had voted for increased spending. Heretofore, the Mississippi River Commission had normally received funds from two sources. River and Harbor bills usually provided small amounts for flood control works, and money to carry out provisions of the Flood Control Act were provided for in the Civil Appropriation Acts. Normally monies provided by River and Harbor Acts were large because each member of Congress wanted something for his district. In election years, however, this source of funds was the first to receive the axe.

In 1920, the House Committee on Rivers and Harbors received a bill calling for about

$42 million in appropriations. Committee members brought out their sharpest knives and, when they were finished, the bill provided for only $12 million. This was really cutting the pork out of the so-called pork-barrel legislation. After a heated debate in the Senate, the $12 million bill was approved but a telling point was made by one senator when he said it was nonsense to enact a $3 billion bill to construct a merchant marine (then under debate) and provide the "parsimonious" sum of $12 million for harbor work.[24]

The River and Harbor Act of 1920 provided no funds for the Mississippi River Commission. However, the civil appropriations bill provided a little over six million dollars to carry on the work on the Lower Mississippi. Allotments from this appropriation gave the First and Second District a little over $1.8 million.

The amount of work completed in the First and Second District reflected the meager appropriations. Only about three million cubic yards of earth were added to a levee system that was nearly 500 miles long. Local levee districts had almost $300,000 in surplus funds to apply toward construction of levees, but the River Commission had no matching



Snagboat "Horatio G. Wright," in 1919. This is a frontal view of an enlarged two-hull Captain Shreve design.

The "Jazz Age" quartering boats (Quarter Boat) did not reflect the giddy excitement of the times.

funds.[25] Of the almost 500 miles of levees in the First and Second District, it was reported that only 143 miles were up to the 1914 grade and section as adopted by the River Commission.[26]

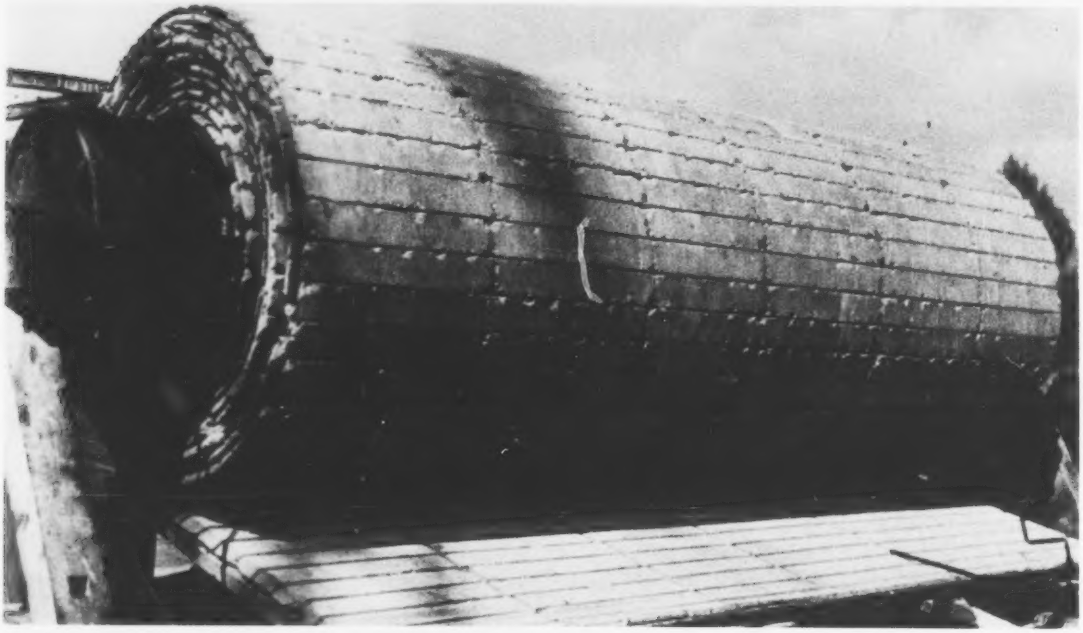
Moderately high river stages were experienced in the First and Second District in 1920. A crest stage of 40.3 feet was reached at Memphis on April 5. Levees under the jurisdiction of the First and Second District presented a solid front to the high water. Some backwater flooding was experienced, but the water was no real levee threat.

High water stages did contribute to the cost of revetment. A large mat, constructed and placed at Hopefield Point the previous year, was washed into the river. No revetment work at all was done in the Plum Point Reach. Less than 5,000 linear feet of revetments were placed on the river banks with the bulk of the work placed at Wyanoke and Porter Lake, Arkansas.[27] All classes of work were hampered and delayed by shortages of labor from the unstable labor conditions brought on by prevalent strikes.

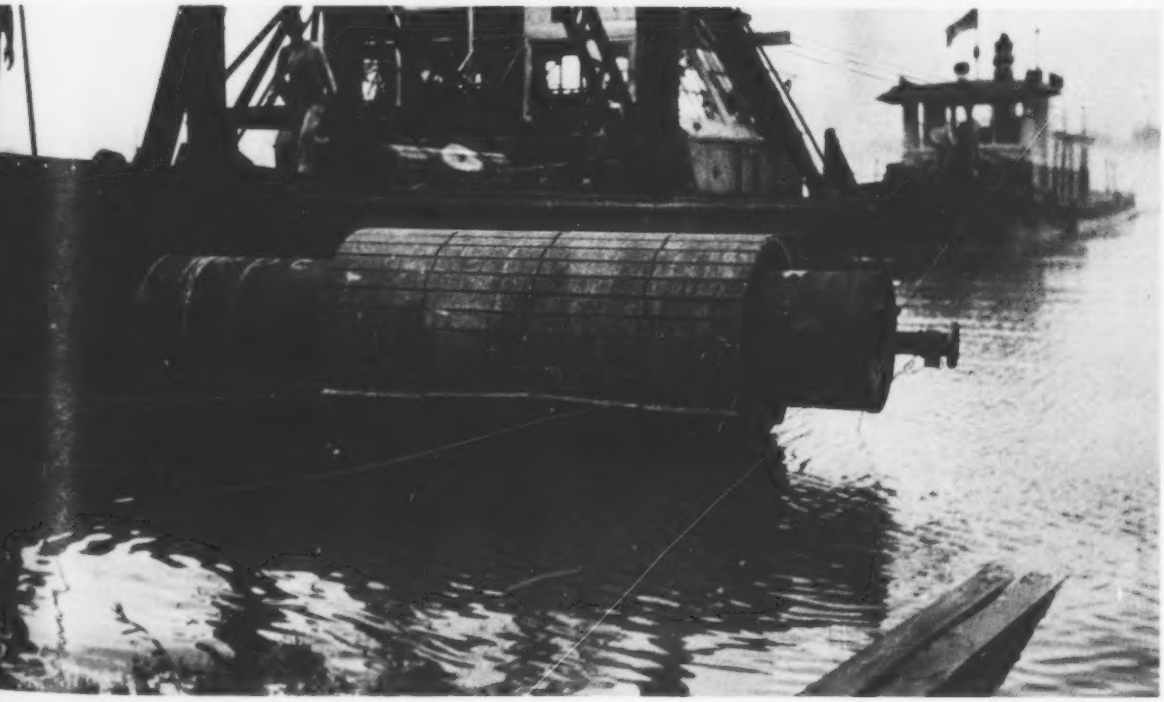
On August 1, 1919, the dredging operation in the Memphis harbor was transferred from the First and Second District to the Dredging District. During 1920, the Dredging District had to use four hydraulic dredges and one dipper dredge to maintain the harbor at Memphis. More than a million cubic yards of mud and silt were removed from the harbor that year and, annually, expenses amounting to almost $60,000 were being spent just to keep the harbor open.[28]

A further menace to the harbor developed in April, 1920. After the formation of Mud Island, Memphis had extended its harbor facilities to the south. But extensive caving of the banks from Calhoun Street to the Rock Island Railway bridge threatened this development as caving for a depth of eighty feet was threatening to cut off the track approach to the Frisco Railroad yards. While on its high-water inspection, the Mississippi River Commission viewed the caving, but decided to await the recession of the water before any plans were formulated to remedy the situation.[29]

Small appropriations by Congress again brought flood control work to a near halt in 1921. Only about 16,000 feet of new revetment was added to the entire river. The more than one thousand miles of levee under the jurisdiction of the River Commission received only $4.2 million for new construction and maintenance. "The science of levee construction had reached a point where not enough money was available to continue the program



In the unending search to find a revetment which would be both easy to install and practical, the Engineers experimented with the drum roll articulated concrete mattress. Although the principle of the modern articulated matt was the same, the drum rolled experiment failed because the mattress was too light to remain in place. The advantage in rolling on the revetment could not offset the short life span of the light mattress. Below photograph illustrates placement of mat.



Volunteer convict labor is often used during times of emergency. Note accompanying guard in background.

The old-time levee camps were places of keen activity. Very often they had a population of 500 to 700 people with tents providing shelter for the levee workers and food being furnished by the levee contractor. The tents were well furnished, usually being divided into two and three rooms, and had wooden floors and one very large tent was maintained as the "eating house." Each tent was heated by a large stove placed in its center. Of the levee camp rules, one was never violated -- no team of mules was sent out to work until it was curried and every particle of mud cleaned off." A few levee contractors carried paid men and women to entertain the workmen. Entertainment was provided for in a large circus tent. Professional dice players followed the levee camps and money at the games often reverted back to the pockets of contractors or some of their bosses. The Mississippi River Commission finally put a stop to the practice as levee camps were ordered to be kept sanitary and all gambling was prohibited except between individuals.[30]

During 1922, the Mississippi River Commission faced a battle on two fronts. Low river stages resulted in the operation of eight dredges on twenty-four crossings between Morrissons (70) and Waterproof (677). Twelve steamers or tows had gone aground in the low water and the steamer *St. Louis* had gone aground twice. More than $12,000 was expended by the Commission through the dredging district in assisting grounded plant belonging to the Federal Barge Line alone, and this amount is no measure of the actual loss to the Dredging District because much of this work delayed the dredging operations.[31]

Floods during 1922 presented the most serious problem for the First and Second District. The river crested at Memphis on April 1, at a stage of 42.5 feet. The levee near Oldtown, Arkansas, was the one most threatened by the water because the levee was near a caving bank. During rising stages, caving continued until it was within sixteen feet of the crown. On March 31st, 150 feet of the crown of the levee was destroyed and it was decided that this area would have to receive protection or the whole levee would fall into the river. The first operation consisted of the construction of a sandbag sublevee on the banquette in the rear of the caving section. Simultaneously, a second sublevee of sandbags with a timber core was at an accelerated, a situation that had not been the case just a few short years before. The River Commission now had twenty-six levee machines while, in the past, levees had been constructed by manual labor and teams of mules pulling scrapers. Levees were constructed as far back as conditions would permit. To protect the levee face from erosion, two layers of cotton bagging were sewed on one-inch chicken wire in sections five feet wide and fifty feet long. At each end of the wire mesh, large twelve-inch cylinders were attached to the chicken wire and filled with rock to hold it in place. This revetment reduced the erosion by fifty percent and saved the levee.[32]

Four crevasses occurred in levees during the flood of 1922 – all in the lower reaches of the Mississippi. Poydras (985L) was the worst of the four in terms of damage, reaching a length of 1,100 feet. Two crevasses occurred at Weecoma (693R) reaching a length of 3,669 feet. The other crevasse was at Myrtle Grove (1,008 R) and washed away 1,000 feet of levee.[33]

In the First and Second District, backwater flooded more than 1.4 million acres of land. The land was submerged from six to eight weeks and slightly longer in some places. Losses in the Memphis District were placed at $3,850,000, exclusive of levees. Almost all of the damage was sustained by the St. Francis Levee District – the total there being $3,250,000.[34] The Mississippi River Commission reported that the area overflowed in the Lower Mississippi Valley came to 4,232 square miles and that they had spent more than $776,000 in fighting the high water.[35]

Between the years 1882 and 1922, Memphis had experienced 447 days when the river was bankfull or higher. The floods of 1922 again showed that much work remained to be done before the Valley would be safe from the waters of the Mississippi. In the Yazoo Basin, more than a million acres had been flooded to a depth of from five to twenty feet. For several weeks, railroad cars were homes to many hundreds of refugees.[36] After almost every flood in the Mississippi Valley, there had been renewed interest in flood control measures. In 1922 it was no different.

Members of a congressional inspection party, consisting of three senators and eleven representatives, toured the Valley to see first hand the damages resulting from the floods. The Mississippi Flood Control Association was organized to bring attention to the fact that the Valley needed help in controlling the Mississippi. This organization, composed of all the levee districts and interested parties in the Lower Valley, would prove to be a most influential group in the move for better flood control work. While Flood Control Association would make its presence known in the future, Congress was still resisting all efforts for the appropriation of large sums for flood control. Congress approved appropriations for flood control amounting to only $6,670,000 and even this sum was reduced by a million dollars because the Congress had already voted this amount in emergency funds to fight the flood of 1922.[37]

Though the floods of 1922 produced no gains in appropriations for flood control, there was one section of the Valley that did receive additional benefits. The River and Harbor Act of September 22, 1922, extended the jurisdiction of the Mississippi River Commission, for the purposes of levee protection and bank protection, to the tributaries and outlets in so far as they were affected by the flood waters of the Mississippi River.[38]

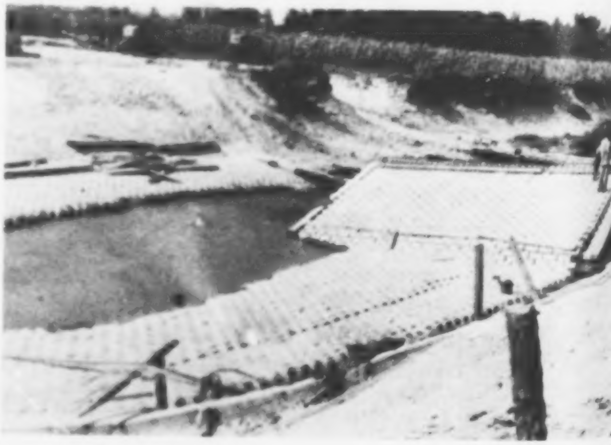
Construction of levees and revetments were delayed by the high water of 1922, and over 13,000 feet of levees on the Mississippi had been destroyed by the floodwaters. Many miles of levees suffered from wave wash, and the debris from the flood would have to be removed from the levees.

Over 6.4 million cubic yards of material was added to the levees in the First and Second District during 1922. This huge placement was made possible by the acquisition of a new type of construction equipment. After World War I, it was found that the Army had many caterpillar tractors that it could not use. The Surplus Supply Division assigned many of these tractors to the River Commission for experimental use in levee construction. One such experiment was carried out in the Memphis District at Whitehall, Arkansas, and it was found that the cost was excessive because of the condition of the machinery. The Memphis District Engineer, however, saw the advantage of such levee construction. During the off season he had all of the machines repaired and asked the River Commission for permission to continue the work during the 1922, season. His request was granted, resulting in increased efficiency in levee construction.[39]

No revetment work was conducted in the Plum Point Reach, but over 11,000 linear feet of revetment was placed at four other locations. The largest placement consisted of 5,184 feet at Trotters Landing, Mississippi.

Revetment of the banks had at one time almost come to a halt because of the increase in construction costs. Between the years 1881 and 1917, the cost of revetment in the First and Second District had been $39.67 per linear foot but construction costs in the period 1918 through 1922, had increased to $90.35. In the face of increased costs, however, appropriations for revetment had not increased to any great degree over the previous years.[40]

A forerunner to the modern-day articulated concrete mattress, the concrete block flexible mat was tried in experiment in the Little River Drainage District, Missouri. Early 1920's.



Expanding the jurisdiction of the Mississippi River Commission to include the tributaries as they were affected by the Mississippi made the allocation of funds even more difficult. The Congress gave no indication that it would take this fact into consideration in making appropriations. The floods of 1922, however, began to change the outlook of many congressmen. In 1923, the Executive Office, through the budget director, asked for only $27 million for rivers and harbors. Congressman Ben Humphreys (D. Miss.), who, like President Harding, would die later in that year, spearheaded the drive for increased appropriations for flood control. The Mississippi River Flood Control Association also played a prominent role in the drive for a new flood control law.

Advocates of flood control were rewarded by two bills during the first few days of March 1923. On March 2nd, President Harding signed into law a River and Harbor Act providing $56 million. Though the Mississippi River Commission received only a little over $5.9 million of this total, the move for reduced appropriations had been reversed. Even as President Harding was signing the River and Harbor Act, Congress was voting on another bill devoted exclusively to the Mississippi River. That same day, March 2nd, Congress approved a new Flood Control Act. Just two days later, March 4th, 1923, President Harding signed it into law.

The act authorized the spending of not more than ten million dollars annually for flood control on the lower Mississippi for the next six years, beginning with fiscal year 1924. A second provision of the bill authorized the River Commission to spend any funds at its disposal on the tributaries in so far as they were affected by the flood waters of the Mississippi. But though a new flood control act was on the books, no great flurry of flood control work was undertaken and appropriations continued to be about what they had been in the previous years.[41]

A depleting reserve of willow brush forced the Mississippi River Commission to accelerate the experiments with concrete as a replacement for willow revetment. By 1923, the Commission, through the various districts, reported that more than 11,000 linear feet of the concrete revetment had been placed on the river banks, but the Commission was not yet ready to abandon the willow mattress.[42] Of the almost four miles of new revetment constructed in 1923, only 1,100 linear feet of concrete revetment was placed on the banks. More than $41 million had been expended on the revetment of banks since it was undertaken by the Commission in 1881.[43]

Construction of levees in the First and Second District was nearing completion in 1923. Levees in the Upper Yazoo Levee District were completed to the 1914 grade and section. All the levees under the jurisdiction of the Memphis Office were more than 75 percent complete, to existing grade and scale, with the exception of those in the White River Levee District. Since the River Commission had undertaken the construction of levees in 1882, it had allotted more than $193 million for levees. The First and Second District share for this levee construction had been more than $54 million.[44]

Development of the dredging fleet had been commensurate with that of levee and revetment progress. By 1923, the Dredging District had eight channel dredges. As each new dredge was built, an effort was made to eliminate the defects of its predecessor. The latest dredge could make a cut through a sand bar six feet deep and thirty-two feet wide at a rate of 360 feet per hour.[45]

The radio also became a valuable tool of the Dredging District. In 1923, the District equipped all dredges and auxiliary craft with radios. A sending and receiving station was placed at district headquarters to relay and accept data on channel conditions.

In 1924, the Mississippi River Commission received its first substantial increase in funds in several years. The full amount of $10 million authorized by the Flood Control Act of 1923 was appropriated. Because of a broader jurisdiction, work completed by the Commission did not increase significantly and only about 2.8 million cubic yards of material was added to the levees in the First and Second District. New revetment amounted to about 8,000 linear feet.

During the high-water inspection by the River Commission, the St. Francis Levee District asked the Commission to expand its revetment operation. The Levee District requested that six locations be reveted because caving banks threatened to carry the levee into the river at Huffman, opposite Blytheville, Barfield, Osceola, Wilson, and Pinckney.[46] Levee district officials were advised that money was not available at the time, but the Commission would take up the project as soon as funds became available.

During 1924, two not unrelated moves were made to curtail the authority of the Mississippi River Commission. The first of these involved the levees. In February, 1924, the private levee contractors of the Mississippi Valley organized themselves and began to protest the levee policies of the Commission. A group of private contractors appeared before the House Committee on Appropriations and charged the Commission with inefficiency and extravagance. It was charged that the Commission was not giving them as much work as they believed was their due. The supporters of flood control attempted to get them to withhold their protest, but it was to no avail. Private contractors wanted it written into law that they would recieve fifty percent of all work.[47] Controversy over the matter continued several months until some vague language was written into law declaring that it was the policy of the government to have levee work done by contractors, if it was feasible.

The second attack on the River Commission came from members of Congress who supported the views of the contractors. The Rivers and Harbors Committee of the House passed a resolution transferring authority over improvements and flood control of the Mississippi River from the River Commission to the Secretary of War. After several weeks of intense pressure, Valley congressmen succeeded in removing the resolution.[48] It was not the first nor the last time vested interests would attempt to undercut the authority of the Commission.

In 1925, President Coolidge who had succeeded to the Presidency, and had then been elected in his own right, said that the number one economic problem of the United

The Dredging District Headquarters became part of the consolidated Memphis District when all offices were moved to the West Memphis Reservation. (Photo 1928)

States was the development and expansion of transportation facilities by the systematic and scientific improvement of waterways.[49] After this wildly encouraging statement, he announced he would veto the R & H Bill. His threatened veto of the River and Harbor Bill cut the appropriation by $12 million, but the Mississippi River Commission received $10 million for continuing work on the Lower Mississippi.

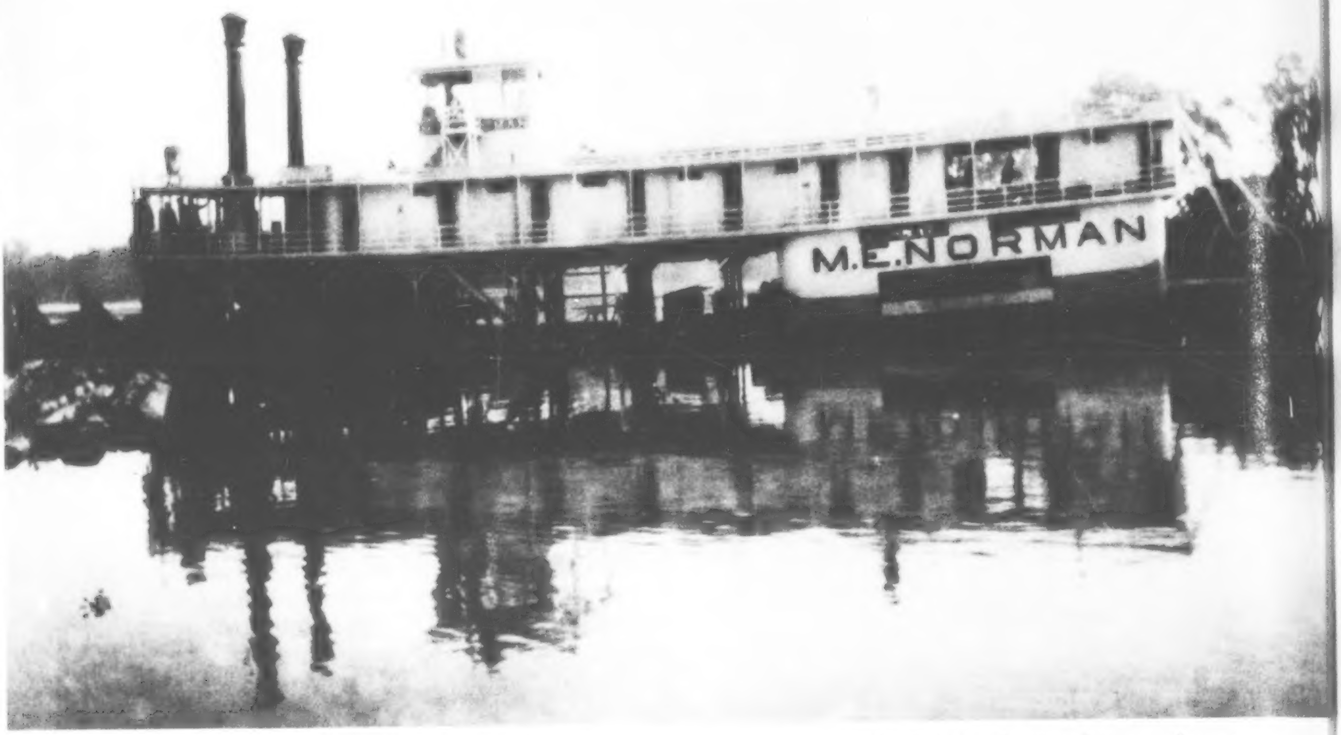
Increased appropriations over the previous two years were reflected in the amount of work accomplished by the First and Second District. Over 15,000 linear feet of revetment was constructed under the direction of the Memphis Office. During the year, 273 slabs of reinforced concrete mats of various sizes were set in at Hopefield Bend. None of them held satisfactorily. However, experiments with concrete were continued in an effort to find a replacement for willow mats.

With increased levee allotments, more than six million cubic yards of new material was added to the levees under the control of the Memphis Office. The general attitude of the levee districts was reflected in the position of the Lower St. Francis Levee District; H. D. Tomlinson, the levee district's President, informed the River Commission that it was prepared to match any allotment that might be forthcoming. One reason more levee construction was being completed was the Mississippi River Commission policy of letting continuing contracts. That policy had reduced the cost of levee construction by more than 50 percent.[50]

The Upper Yazoo Levee District developed a way of augmenting its levees construction fund. A custom of growing Bermuda hay on the levees was instituted. The hay was sold to local interests at a price of eighteen to twenty-two dollars a ton, thus the grass both stabilized the soil and helped pay its own costs.[51]

In 1925, the First and Second District undertook an experiment with sand dams as a means of channel regulation. Two of the dams were built at Island No. 35. The main river channel in 1925, followed near the west bank west of the island and on the east side of the island was a chute channel. The first dam was designed to close this chute channel and the other, the second dam, to close a small secondary channel at the foot of the island. Constructed by hydraulic methods, the dams were covered with brush mattresses and ballasted with stone. The experiment was a failure. The first of the dams was completely destroyed by the currents and the other was saved only because channel changes relieved it from attack.[52]

In May of 1925, a great tragedy struck one of the boats belonging to the Engineers' fleet at Memphis. Acting as host to the American Society of Civil Engineers, then holding their

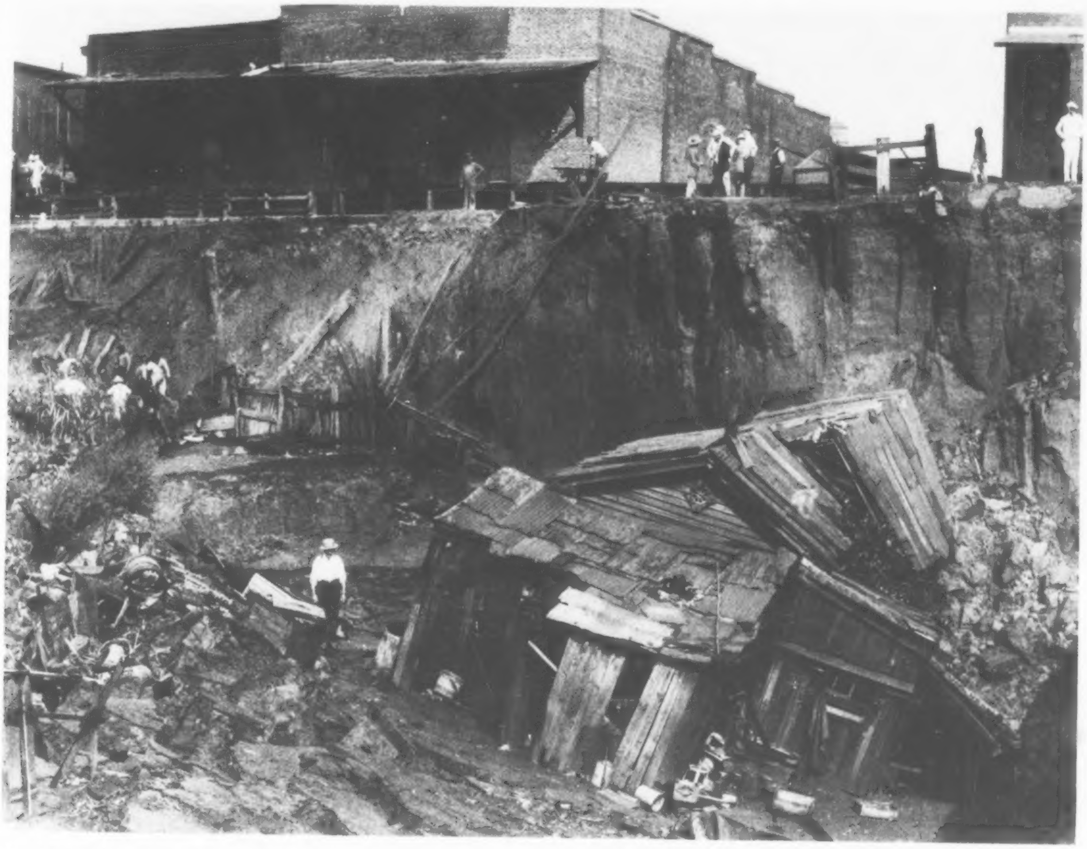


The "M. E. Norman," built in 1924 but infamous for the tragedy of its loss in 1925. Twenty-three people met their doom despite their rescue efforts of a Black, Tom Lee. Lee received national recognition and fame for his heroics, and a statue at a Riverfront park in Memphis commemorates the deed.

convention in Memphis, the Engineers had invited their guests and families to join them in an inspection of the Cow Island revetment. The response to the invitation was so large that two boats, the *Choctaw* and the *M. E. Norman*, had to be utilized. When the inspection was completed a majority of those attending boarded the nearest boat, the *Norman*, and it departed for the 20 mile return trip. The *Choctaw* steamed on by with its light load and was soon out of sight. Just below Memphis disaster struck. The vastly overloaded *M. E. Norman* began to list to one side, allegedly from shifting fuel; the passengers were alarmed and rushed over to the opposite side. The imbalance was too great, and the *Norman* rolled over, spewing its human cargo. Even as some of the survivors tried to cling to the sides of the upside down vessel it upended and slid under the muddy Mississippi. Twenty-three people went to their deaths, while seventeen others floundered to the Mississippi side of the River, but thirty-two others were saved by a husky, river roustabout, Tom Lee. A 39-year-old Black, Lee had been operating a small contractor's river boat just ahead of the *M. E. Norman*, and upon hearing the commotion he not only returned to the scene to pick up survivors, he made two additional trips depositing people on the shore and returning for others. Of the people in the water, Lee was later to say: "They didn't lose their heads like a lot of crazy folks. . . (they were) the sensiblist drowning folks I ever saw." After he had picked up all the visible survivors Tom Lee gathered some driftwood and built a fire on the beach so that they could dry out and ward off the chills, then he spent the remainder of the evening and night patrolling the river looking for other members of the tragic party. Tom Lee was immediately acclaimed and sustained as a hero, and President Coolidge paid tribute to his courage by inviting him to the White House. A large fund was collected by the grateful Society of Civil Engineers, and the money was used to purchase a house for Tom Lee and his wife. At the instigation of E. H. Crump, a part of the river front was filled in and a park and monument erected in the honor of Tom Lee. In 1936, a bronze plaque memorializing those lost in the *Norman* disaster was placed on one of a pair of columns installed by the Corps of Engineers at the entrace to the old Army Engineer reservation in Arkansas. In August of 1963, those columns were removed and reinstalled at the entrance to the new Ensley Engineer Yard in south Memphis. Though Tom Lee died in 1952, he is still remembered with gratitude by the Engineers at Memphis.[53]

Under a directive from the Mississippi River Commission, the Memphis District in 1924 had begun once again to conduct revetment experiments with lapped slab concrete. In drawing an analogy, the lapped slab revetment would look like a row of dominoes that had been standing on their ends. Push the first one and the whole row falls leaving the end of each domino resting on the end of the one in front of it. By 1926, the plant and expertise required to place such a mat had been developed and, that year, the Memphis district placed more than 11,000 linear feet of revetment at seven locations. At Cow Island Bend, Arkansas, 3,060 feet of the lapped slab revetment was placed on the banks and another 1,995 feet was placed at Knowlton, Arkansas. These experiments were not entirely satisfactory and in subsequent years changes would be made to improve them.[54]

A controversy relating to revetment occurred in 1926. The controversy placed the district engineer in the middle of a heated argument between the Mississippi River Commission and officials of the City of Memphis. In July, 1926, a large section of the river bank at Memphis subsided and almost caved into the river. It involved an area about 1,100 feet long, with an average width of 120 feet. Vertical movement of the slide was approximately sixty feet. The subsidence carried with it practically all of the yard and plant of the West Kentucky Coal Company. A Construction Committee of the River Commission visited the area of the slide and estimated the damage at nearly a million dollars. It was recommended by the committee that no repairs be undertaken by the River Commission because it could not be classified as flood control or navigation work. The River Commission concurred with these findings, but the Memphis District Engineer recommended that the work should be done because the slide had been caused by the old revetment of Hopefield Point, which had thrown the current into Memphis harbor. Senator Kenneth McKellar (D. Tenn.) protested the decision of the Chief of Engineers, who ordered that the matter be reopened. Nevertheless, it would be several years before the caving was rectified.[55]



In 1926 the Memphis Bluff suffered major cavings, taking with it shacks, businesses, boardwalks, and even a railroad spur, complete with steam engine. (Not visible in photo.)

Under the direction of the River Commission, 7.9 miles of new revetment was set in place in 1926. Almost twenty-three million cubic yards of new material was added to the levees. There were more than 122 miles of revetment on the banks of the Mississippi River. Of the more than 1,833 miles of levee under the jurisdiction of the River Commission, 1,815 had been completed to the 1914 grade and section. Including local contributions, since 1881 the Commission had expended more than $228 million in the construction of levees. More than $57 million had been spent in reveting the banks. From the creation of the Mississippi River Commission to June 30, 1926, the total specific appropriations made for expenditure under it on the Mississippi and its tributaries had been more than $168 million.[56]

In 1926, the Mississippi River Commission could boast of the work they had accomplished in the past forty years with satisfaction. They felt that the day when the Lower Mississippi Valley would be safe from the ravages of floods was within sight.

But in 1927 a "yellow dragon," not spitting long streams of fire, but millions of cubic feet of yellow water per second, decended down from the Mississippi Valley. A swish of the tail here and there and the levees failed, flooding thousand of acres of land. There were few areas that escaped his wet breath. The Engineers looked at the "yellow dragon," in awe, knowing then that they had not tamed it, nor did they have it under control. The giddy era of Fords, flappers, and booze seemed to demand something exciting from nature, but there was nothing entertaining about the Great Flood of 1927.

CHAPTER IV

The Crisis – The Flood of 1927

Three widely-held misconceptions of floods on the Mississippi River were put to rest by the flood of 1927. First, it was assumed that there could be no major flood in the Mississippi Valley unless the Ohio River provided substantial amounts of water. Second, that it was unlikely that all or a major portion of the tributary streams would produce floods simultaneously. Third, even if a major flood of such magnitude should occur, it would proceed down the Valley at such a leisurely pace that the people would have ample warning to save themselves and their property.

What Secretary of Commerce Herbert Hoover called "the greatest economic disaster in the history of the United States" was caused primarily by heavy precipitation, though there were other contributing factors.[1] Incessant rains falling since September, 1926, had produced unprecedented high stages for that time of year. The maximum stage at Memphis that September reached 25.1 feet, the month's highest stage at Memphis in 54 years.[2] From September, 1926, to the end of December, 1926, the river at Memphis never fell below 15 feet on the guage and during most of the months, the river stage was above the 20 foot stage.[3]

The flood of 1927 came in three waves. A steady rise of the river from January 1, 1927, culminated in a stage of 37.7 feet at Memphis on January 12, or 2.7 feet above flood stage. A decline set in that bottomed out on January 22, at 20.9 feet. The second wave of the flood began at this time, reaching 37.8 feet on February 12. A slight fall set in, but it never went below 30 feet. It was at this point, on April 5, that the third wave began, becoming the Great Flood of 1927.[4]

Between December 18, 1926, and April 30, 1927, the rain that fell throughout the drainage basin of the Mississippi River accumulated to a grand total of 244.4 cubic miles. This figure is meaningless unless it can be compared to some other phenomenon. One method of showing the tremendous amount of rainfall is to note that the total movement of water carried by the Gulf Stream through the Straits of Florida in a twenty-four-hour day is 240.7 cubic miles, or 3.7 cubic miles less than that which fell over the drainage basin of the Mississippi River between December 18, 1926, and April 30, 1927.[5]

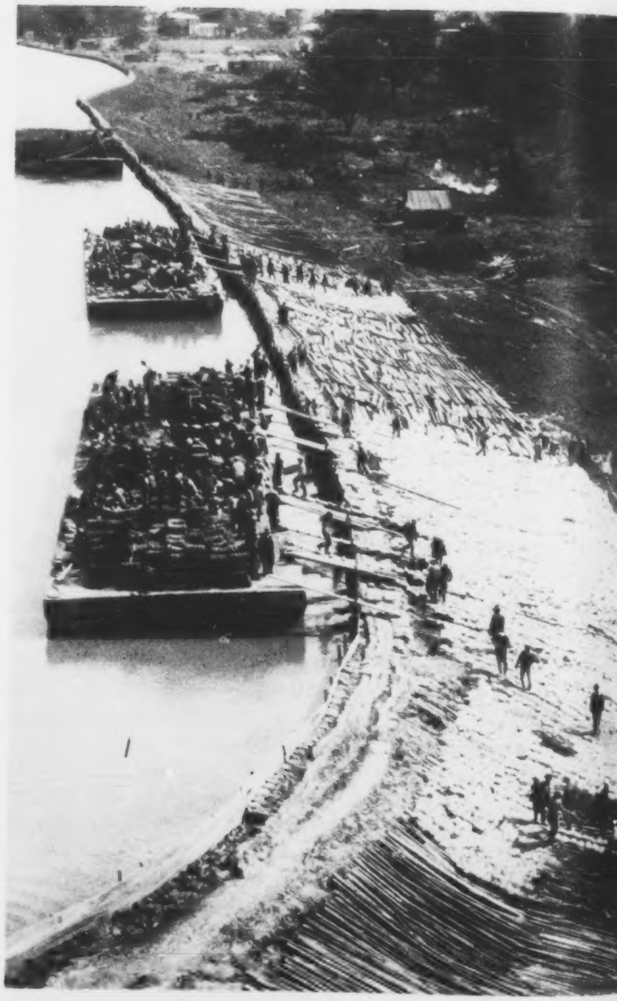
After heavy rains during the first weeks of March, the Weather Bureau at Memphis issued a warning on March 21, 1927, that the river would probably go to at least 42 feet. Owners of livestock and movable property were advised to take appropriate action.[6] In April, the Corps of Engineers announced that the flood would exceed that of 1922, and the Weather Bureau revised its crest stages to reflect a record breaking flood.

Because of excessive rainfall and high stages of the river occurring during the early part of 1927, the levees under the jurisdiction of the Mississippi River Commission were already saturated. High water had been against the levees for extended periods of time, and there was increased danger of levee failure. At Cairo, the river was against the levees for 88 days, at New Madrid for 108 days, at Memphis for 107 days, at Helena for 111 days, at New Orleans for 120 days, and at Yazoo City and Vicksburg for 166 days.[7]

There were two minor breaks in the levees near Tiptonville, Tennessee and Deering, Missouri, the latter on the St. Francis River. The break at Tiptonville was repaired immediately with sandbags and resulted in little damage. It was reported that the levee at Deering was dynamited by unidentified persons.

On March 27, the river at Memphis topped the 40 foot stage and claimed the first death attributed to the flood. Miss Mattie Hays, age 16, was drowned near Ridgely, Tennessee when the skiff in which she was being taken to safety overturned. No one could know it at the time, but Miss Hays was to be the first of more than 200 that would die as a direct result of the floods.

The first sign of real trouble developed at Laconia Circle. This area might have been known as the "circle of fear." During practically every major flood, the circle levee had given way to the onslaught of the river. The Mississippi River Commission, only the previous year had allotted funds to set the levee back from a dangerously caving bank, but the allotment had been withdrawn because local interests had not contributed their share of the cost. There was extensive caving along a 250 foot section and, for a distance of 60 feet, the caving had reached the toe of the main levee. On March 29, the raging river tore away a one-acre section of the bank. The undermined levee collapsed creating a crevasse and flooding the 12,000 acres inside the circle. Nearly 2,000 people were driven from their homes as[8] floodwaters inside the Circle ranged from fifteen to twenty feet deep. To relieve the situation, a small crevasse was opened in the back levee on the west side of the circle.



The Great Flood of 1927 created many unusual conditions that called for unusual remedies. Here we see a levee that is being paved on the landside slope, with sandbags overlaying wood and brush stabilizers. The levee has already been raised once, and is again in danger of being topped, thus it was necessary to reinforce the slope before attempting further repairs.

The second week in April brought more rain to the Mississippi Valley. Up to this point, the Corps of Engineers had fought the flood to a standoff. District Engineers and local levee interests had recruited an army of flood fighters for patrolling the levees and conducting emergency operations. The Engineers took advantage of two new developments in fighting the flood of 1927. For the first time the Engineers used commercial radio stations to broadcast flood warnings and radio station WMC at Memphis was used to recruit floodfighters. The second development was the first use of airplanes in floodfighting. The Red Cross reported that a fleet of 30 airplanes covered the entire disaster area twice each day with flights totaling 75,000 miles during the disaster.[9] Up to this time levee inspection had consisted of walking or riding a horse along the levee.

On April 15, the National Weather Bureau at Washington issued a warning that every precautionary measure should be taken because the flooding would be the greatest on record. The citizens of Columbus, Kentucky, could testify to these pronouncements, for water was standing five to fifteen feet deep in the city. Water was two feet deeper in houses than it had ever reached in previous floods. Memphians could also complain, for they had not escaped the ravages of the flood. Over three and one-half inches of rain fell on Memphis during a 12 hour period on April 15. Water was nearly three feet deep along Tutwiler Avenue from Idlewild to McLean. Linden Circle appeared to be an inundated town.[10]

Every national crisis will have its related stories of personal heroism, and the Flood of 1927 was no exception. One such hitherto unknown story is the story of Sam Tucker, now retired from the Memphis District. Tucker, an unschooled Black, had been working on the levee just above Laconia Circle, and on the evening of April 21 he and his exhausted levee crew had been returned to the quarter boat for food and rest. One of the major developments of the day had been the Knowlton's Landing levee crevasse. The quarter boat had been located just above the break in order that the crew could be on hand the next day to try to contain the crevasse. Since the whole levee seemed in danger of giving way, Sam had spent part of this off-duty period trying to warn the lowland inhabitants of their danger, but they had paid him no heed.

A few miles below the crevasse the government work-boat *Pelican* picked up another exhausted levee crew and headed upriver for the quarter boat. The *Pelican* was a metal hulled, open cockpit vessel, sometimes called "the bathtub." It was about thirty feet long, with an eight foot beam, and was powered by a little two-cylinder gasoline engine. There was no cabin, but there was an open frame sun roof which could be enclosed with heavy canvas curtains in times of bad weather. It was a functional and quite adequate boat for almost all circumstances, but this was an evening of high winds, hail, heavy rain, and of course raging floodwater. In order to give maximum protection to the eighteen men who were being transported, the operator of the boat, Mr. Henry Cooper, had his two assistants, Henry Owen and Will B. Morris, fastened the canvas curtains securely around the open frame of the roof and the island of weary humanity chugged its way up river.

Julius Elder elected to remain outside the make-shift cabin, to talk with Cooper and Owens. Because it was bitterly cold, Elder donned two lifejackets.[11]

Mr. Cooper finally spotted the lights of the quarter boat, but as he headed his vessel for those lights he first heard and then saw the crevasse before him. He started to reverse the engines but, underpowered, the boat was unable to buck the current of the crevasse. Unknown to Cooper a much larger boat, the *Griffin*, had barely escaped a similar fate just a short while before. Cooper tried to avert the disaster by putting the nose of the *Pelican* into the bank just below the crevasse, but the impact only widened the crevasse, and the *Pelican* was swept into the vortex. The rear of the boat swung around rapidly, causing it to hang on the levee briefly, but also assuring that the full brunt of the current would slam against the side of the vessel. The *Pelican* was then smashed through the opening, tumbling over and over as it was carried along with the relentless current. The sun roof splintered, both spewing and entrapping men, but there was no relief in the murderous waters. Of the 21 men on board, 19 including Cooper and his assistants, were drowned immediately. Those who had witnessed the disaster from the deck of the quarter boat and on the deck of the steamer *Wabash* could not believe that any had survived such a tragedy. A runner was sent to telephone a report, but only the roar of water and the howl of wind disturbed the ominous quiet. No one was willing to brave the crevasse and storm to initiate an unlikely search for survivors. No one, that is, except Sam Tucker.[12]

Tucker unhesitatingly jumped into a skiff and took that skiff directly into the crevasse. Rowing with the expertise of one who had been raised on the river, as indeed he had, he shot through the crevasse, stabilized the boat, and then began drifting down current on the other side of the levee, dodging obstacles and listening for any sounds of survival. At about three-quarters of a mile down current he heard two voices weakly calling out in unison, and – directed by their voices – he found the only two survivors of the tragedy. Julius Elder, with his two life-jackets, and Oscar Clemmons, who had clung to Elder, had been washed into a thicket of willows, and had clung tenaciously against wind and current. Sam pulled them into the skiff, where they collapsed in exhaustion.[13]

In their utter fatigue both Elder and Clemmons went into deep sleep while Sam undertook the most exhausting part of the mission, the rowing upcurrent in the dark and uncertain night. That return "pull" is one that Sam will never forget, and to this day he proudly displays the distended muscles of his sinewy arms, evidence of the strain of that sustained effort. Pulling against heavy current and near impossible weather, the return trip took over three hours.

Although Sam Tucker became a contemporary hero among his fellow Blacks, the story was never made public before this author began picking up bits and pieces of it. Undoubtedly the magnitude of tragedies and heroics coming out of the Flood of 1927 militated against any special recognition of this incident, but other events could not lessen the actual heroics of the moment. In the intervening years Sam has become increasingly bewildered that Tom Lee's effortless daylight rescue brought such fame and publicity while his "story" went untold. This then, is Sam's story, "for the record."[14]

Sam Tucker, hero of 1927 tragedy, shows author one of the willow trees which evolved out of the last willow mat placements. Tennessee chute. (Photo taken 1972.)

Levees under the jurisdiction of the Mississippi River Commission were taking the brunt of the attack by the floodwaters. The first of the mainline levees gave way on April 15th. For several months, caving banks had threatened the levee near Whitehall, Arkansas, about fifteen miles above Helena. The Commission had recognized this danger and had authorized the construction of a loop levee. Construction of the new levee was underway when the floodwaters came but bad weather had hampered the work. On April 15th the water was within the five feet of the crown of the old levee at Whitehall when the levee suddenly caved into the river.[15] The width of the crevasse grew to 1,250 feet before the floodwaters finally stopped flowing through the gap and the backwater flooded 80,000 acres and made 8,500 persons homeless.

After the crevasse at Whitehall, the scene of heavy floodfighting shifted to the north. Near Dorena, Missouri, the district engineer recognized a problem area and work on topping the levee was already underway. On April 16th, the force of the river current pushed out 1,000 feet of the levee as if it was made of paper. After the initial break, the levee crumbled into the water at the rate of one foot every fifteen minutes.[16] The crevasse at Dorena was not unexpected and the United States Coast Guard steamer *Kankakee* was on hand to remove people from the flooded area. This Dorena crevasse flooded 135,000 acres of land in the St. John Levee and Drainage District and made 7,500 persons homeless.[17]

The Engineer reservation under siege in the Flood of 1927.

Three days after the crevasse, the water overtopped a ridge levee between New Madrid and Farrenburg, Missouri, for a distance of four to five miles. Releasing a vast amount of water into the Upper St. Francis Basin, the water came into the town of New Madrid from the rear. By April 20, the water inside the city was 1.5 feet higher than in the Mississippi River in front of the town. Workers from the Corps of Engineers were sent to the area with tons of dynamite. The levee at the southern end of St. John Levee District was blasted away, allowing the waters to return to the Mississippi.[18]

Great Flood of 1927, at Clarendon, Arkansas. Looking up river showing junction of White and Cache River.

After the crevasse at Dorena, the Lower St. Francis Levee District increased its 100 levee guards by an additional 300 guards. In addition, twenty-five engineers and levee inspectors were at work on the levees. At Jonesboro, Arkansas, Deputy Sheriff Mack Rogers was dispatched to arrest several "well known" farmers on charge of levee dynamiting. The warrants charged that they had broke the Gum Slough ditch levee to protect their farms.[19] The St. Francis River levee near Deering, Missouri, was also blown by a dynamite charge set by "unidentified" parties.[20] It was reported that the roar of levee crevasses could be heard over a half mile distance, and that once a levee crevassed, the remainder would decay at the rate of four feet per hour.[21] Torrential rains and high wind increased the pressure on the levees. In a fifteen hour period on April 20th, 4.8 inches of rain fell on Memphis. This brought the total rainfall since January 1 to 31.46 inches, 12.81 inches above the normal for the period. In the first twenty-one days of April, Memphis had 12.02 inches of rain.[22] At Knowlton, Arkansas, where the *Pelican* tragedy had occurred, the water-soaked levee had been authorized by the Mississippi River Commission, but the inability of local interests to provide funds had delayed the work.[23] The crevasse at Knowlton flooded 100,000 acres and forced several thousand people to leave their homes, as well as causing the 19 deaths previously mentioned.

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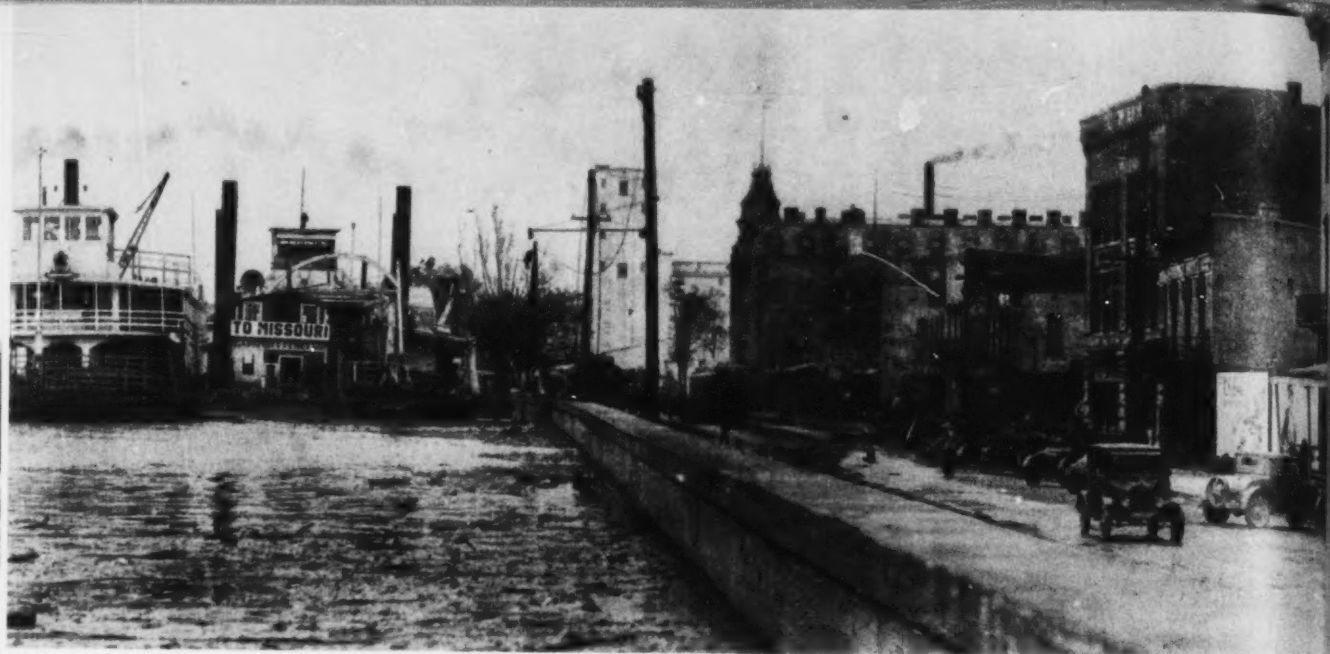
Improvised elevated boardwalk at Greenville, Miss., a refugee center. 1927



Dramatic picture of floodwall at Cairo, Illinois, during Flood of 1927. Normally the River bank is about 100 yards from the floodwall, and a gate in the wall is opened for access to ship landing area.

Individual disasters abounded. At Leland, Mississippi, several refugees took shelter in a building only to have the building catch fire.[24] In the St. Francis Levee District one plantation owner lost 40 of the 42 houses he had built for his workers. One house was pulled from the St. Francis River three separate times before it finally got away.[25] At Greenville, Mississippi, "six or seven thousand" refugees were crowded onto one three mile stretch of levee, with no water, no lights, no sewerage provisions, little food, little clothing, and very little relief in sight.[26] The surrounding cities of Hollandale, Moorhead, Indianola, Belzoni, Percy, Silver City, Rolling Fork, Myersville and other small communities were all under and evacuated.[27]

Probably the most disastrous crevasse occurred at Mounds Landing near Scott, Mississippi. The Engineers had made several inspections of this area because it was just below the confluence of the Arkansas and Mississippi Rivers. A flood of major proportions on the Arkansas River had already broken the levees in several places and the levees on the east side of the Mississippi would receive the full force of the tremendous amount of water coming out of the Arkansas River.

On April 21st, the levee gave way. At the point of the break a ferryboat had been making frequent landings against the levee, placing it in a weaker condition. The water had been creeping toward the top of the levee and was above the banquette when the top portion of the levee gave way. William Alexander Percy recalled, "the river pushed, and the great dike dissolved under their feet. The terrible wall of water like an imbecile blind Titan strode triumphantly into our country. The greatest flood in American history was upon us. We did not see our lands again for months.[28]

The levee broke at about the time most people of the area were preparing breakfast. Within two hours of the time of the break it had widened to a quarter of a mile and was one-half mile wide by noon. The crevasse ultimately reached a width of 3,300 feet.[29] Water from the crevasse inundated Greenville, Mississippi, a city of more than 15,000 at the time.

A report to the Memphis Engineer District on April 22nd stated that there was "no water; no lights; sewerage out. Food for two weeks on hand."[30] On the Greenville levee, the weight of the six or seven thousand refugees began causing the levee to sink and many had to be removed to Vicksburg. As a result of the Mounds Landing crevasse, nearly 2,000 square miles of land were overflowed. Leroy Percy, former Senator from Mississippi, stated that in the floods of 1883-84 there were 700 breaks in the levees. "Thirty-four miles of levees were swept away; yet the single break in the levee at Mounds Landing, Mississippi in 1927 wrought more havoc and destruction than all the 700 breaks."[31]

Below Vicksburg there were several crevasses. On the afternoon of April 23rd a crevasse near Junior, Louisiana, was caused by the levee being ramed by the *S.S. Inspector*. The ship was grounded in the levee for several weeks preventing the closing of the crevasse. In order to relieve the pressure on New Orleans, an artificial crevasse was made at Caernarvon by dynamiting on April 29th. Breaks at Glasscock and Winter Quarters were the last major crevasses below Vicksburg.[32]

The flood of 1927 was described as "a yellow sea stretching a thousand miles from Missouri to the Gulf of Mexico, from 50 to 100 miles in width, rendering more than 700,000 people homeless, putting 600,000 of them on the charity of the Red Cross.[33] Many residents of the Valley had to contend with more than the flood. On May 8th, earth tremors along the New Madrid Fault sent shocks out over a 250 mile radius, toppling chimneys and shaking pictures off the

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Hughes, Arkansas, during Great Flood of 1927. April 30, 1927.

Property damage was extensive in flood of 1927. Greenville, Mississippi.

walls.[34] Two days later, a tornado carrying its accompanying destruction traveled a path roughly along the St. Francis River. First reports stated that more than 150 died from the effects of the storm. However, this figure was later revised downward and no accurate count of the dead was determined.[35]

Human suffering and property losses characterized the 1927 flood. The death toll of 246 surpasses any flood on the Mississippi River before or since 1927. Damages resulting from the flood were placed at over $236 million by the Mississippi River Flood Control Association. More than 137,000 buildings and homes were either destroyed or damaged. Livestock losses were placed at more than a million cattle, hogs, and poultry. The Mississippi River Commission expended $6 million in fighting the flood. Local levee boards contributed more than $2.3 million in additional funds to fight the flood.[36]

Acreage flooded in 1927 cannot be understood by the figures alone. In the Yazoo Basin, for example, the area flooded came to 500,000 acres. If this acreage was overlaid on some recognizable surface, such as a 20 foot wide highway, the surface would be 207,231 miles long and would reach from New Orleans to Liverpool thirty-nine times, it would reach from San Francisco to New York sixty-two times, and would encircle the earth at the equator a little over eight times. Such a highway would be eighty-three times as long as the Mississippi River. However, the flooded area in the Yazoo Basin was only a minute portion of the lands overflowed. It is beyond comprehension to develop some type of comparison when more than 25,000 square miles are overflowed.[37]

Relief Operations were carried out by the Red Cross and other agencies, all coordinated under Herbert Hoover, Secretary of Commerce. President Calvin Coolidge issued a proclamation calling on the country to aid the suffering, but Coolidge resisted pressure from Congress to call a special session to provide relief and emergency appropriations. Coolidge contended that the emergency would be over before Congress could assemble. Thus, the bulk of the relief operation depended on private contributions.

Coolidge first called for a total $5 million subscription to the Red Cross and then, at a later date, he called for another $5 million. The people of the nation responded to these calls with ever increasing amounts, but money was not the largest obstacle to relief operations. Men and material were harder to come by. The Corps of Engineers furnished men and boats when they could be spared from the flood fight and thousands of refugees were picked up by the Engineers and carried to refugee camps. To relieve the critical shortage of relief boats, fifty medium size craft were built in a single night by a Memphis factory, and given free of charge to the Red Cross. The next day, these boats were fitted with small engines and rushed into service.[38] The railroads contributed significantly to the relief operation by providing transportation, while many of their railroad cars served as homes for the refugees.

The flood of 1927 also produced health problems. Water and sewerage systems were destroyed by the flood. Drinking water had to be boiled before consumption. H. L. Mencken, not noted foı ıis love of the South, had previously called the area the "pellagra and chigger latitudes." Now those epidemics of Pellagra were reported in both Arkansas and Tennessee and red cross workers distri-

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Hughes, Arkansas, during 1927 Flood.

buted thousands of immunizations against infectious diseases. Floods coming at frequent intervals were having a long-term effect on the health and development of the people of the Valley. Dr. Arnold Keagle reported that the recurrence of those disasters amounted to "blow upon blow" when applied to delicate nerve cells. The cumulative effect of the reoccurring blows was to knock out the source of energy and ambition; it was a disease "gnawing at the very root of man's desire to exist."[39]

By the middle of May, the worst of the flood had passed Memphis but that, unfortunately, was not the end of the flood. In June a fourth flood wave came down the Valley, resulting in more havoc because none of the previous crevasses had been closed. Many thousands of acres were again flooded. The district engineer at Memphis, however, saw no real cause for alarm when queried about the "June rise" in the river. He had made a study of the river and generalized as follows:

> The gage records of this office indicate that during the past 30 years the Memphis gage has never exceeded the flood stage later than the 27th of May, and only twice during that period after the 15th of May. In other words, the so-called 'June rise' is more imaginary than real as far as the Mississippi River below Cairo is concerned.[40]

What the Mississippi River had done in the past did not necessarily indicate what it would do in the future because the river is not restricted by custom. In 1927, the river proved the District Engineer wrong. After dropping to just under 31 feet on the gage at Memphis, the river began a slow rise on May 28th. Passing the flood stage of 35 feet on June 6th, the river crested at 39 feet on June 15th. In June, the river remained above flood stage for sixteen days.[41]

The Great Flood had covered parts of seven states, had driven over 600,000 men, women and children from their homes, had destroyed over 2,726 houses and damaged over 22,000 others, had closed down more than 3,000 miles of railways for periods of up to four months, had destroyed cattle, mules, horses and hogs to an estimated value of $1/3 million, with a total flood damage estimated at from $200 to $400 million, and had taken up to three hundred lives. The Great Flood was fully justified in the phrase coined by Herbert Hoover, who characterized it as "The greatest peace-time disaster in our history."[42]

The magnitude of the flood and disaster of 1927 brought home, at last, the realization that the problems of the Mississippi River were national problems. It was not a problem peculiar to the area adjacent to the river, because the Mississippi River received waters from at least two-thirds of the states composing the United States at the time. Herbert Hoover advocated prompt and effective flood control legislation and repair of all the levees, whether under government jurisdiction or not.[43]

In debate over flood control following the flood of 1927, numerous solutions were proposed among them were levees, reservoirs, spillways, and floodways. There were also the usual crackpot schemes; One suggestion made was that huge holes be bored in the bottom of the river and capped with valves so that during flood seasons the valves could be opened and water allowed to escape through the bottom. Another person advanced the idea of laying a line of large pipe on each side of the river from St. Louis to the Gulf and so fix the device that excess water could be thrown over into the pipes and shot straight to the Gulf. Another suggested that large river steamers be tied together and placed in the stream opposite each city threatened by the flood waters. They would be anchored and the paddle wheels started at full speed so as to hurry the water along to the sea.[44] Obviously, some ideas were at least as capricious as the River.

Before the flood of 1927, the Mississippi River Commission had evolved into a "levees only" policy of controlling floods. The 1927 flood forces a re-examination of that policy. Levees alone were not adequate because levees could be constructed only to an optimum height and, beyond that point, their usefulness as a flood control device was dubious. A "levee only" policy was abandoned with the enactment of the Flood Control Act of May 15, 1928. This act contemplated enlarging the levees, but companion structures such as floodways and spillways were also adopted. The act also authorized large-scale revetment of the banks along with dredging and training works to confine the river to a fixed channel.

Aerial view of New Madrid, Missouri, during the Great Flood of 1927. Note the height of the water against the levee, and what might have been had the levee not been in place.

General Edgar Jadwin

CHAPTER V

Jadwin: The Man and The Plan

Even before the 1927 floodwaters of the Mississippi had returned to the channel, President Coolidge ordered General Edgar Jadwin, the Chief of Engineers, to gather data with a view to controlling the floods of the Mississippi. Jadwin was the epitomy of the army command structure. His record indicated an ability to get things done. He had seen action during the Spanish-American War and World War I, and in the interval between these two wars, he had been part of the team of Engineers that had constructed the Panama Canal. He was the type of general who would make a decision and expect all subordinates to support the decision. He was quick tempered and was not adverse to taking on congressmen who questioned his position. Jadwin had his supporters and detractors, but most "riverfolk" of the Valley looked on the technical head of the engineers (as) a "stately official in some white marbled palace in Washington."[1]

Under instructions from the President, Secretary of War, and Chief of Engineers, the Mississippi River Commission was directed to report on methods and estimates for flood control and river improvement on the Mississippi. In addition, General Jadwin appointed four committees to explore other possibilities. The first board was to devote its time to the feasibility of using diversions as a flood control device. Another board was to report on the desirability of any changes in the navigation project. A third board was to study a section of the river below the mouth of the Red River to determine if spillways could be used on the lower reaches of the Mississippi. The fourth board was ordered to study the possibility of aiding flood control by the construction of reservoirs.[2]

Even before the collection and reduction of the data had been received, General Jadwin had already established the outlines of a plan that he had been formulating for several months. At the outset, Jadwin believed that the project needed revision. The control of the Mississippi had developed from what had been considered a purely local problem into what was now considered to be a national problem. Previous plans had been too ambitious in undertaking a complete reclamation of land with limited funds. It had become obvious that any new plans would have to be more flexible, both with concepts and with expected expenditures. According to Jadwin, the geological history of the Valley and the behavior of the river in the past would be taken into consideration. A new plan would have to both stand the test of time and be in tune with nature.

> "The real problem is to find the solution that is sound as to both engineering and economics; the solution that best fits the existing conditions, while lending itself to such modifications as changed conditions and the experience of the future may prove desirable."[3]

The tone of the debates was set even as the Mississippi River was returning to its channel. General Jadwin and Secretary of Commerce Herbert Hoover released a joint statement on flood control. Building of bigger and stronger levees from Cairo to the mouth of the Mississippi, supplemented by spillways that would take off the flood waters, was seen as the only flexible solution to the flood problems of the Mississippi Valley.[4]

Debates on flood control measures were held throughout the summer of 1927. Flood control became the favorite topic of Rotary Clubs, Lions Clubs, and various other service clubs. However, the spearheads of the debate were the Chicago Flood Control Conference and the Mississippi River Flood Control Association. Pressure by these two organizations resulted in the House Committee on Flood Control conducting hearings even before General Jadin submitted his plans.

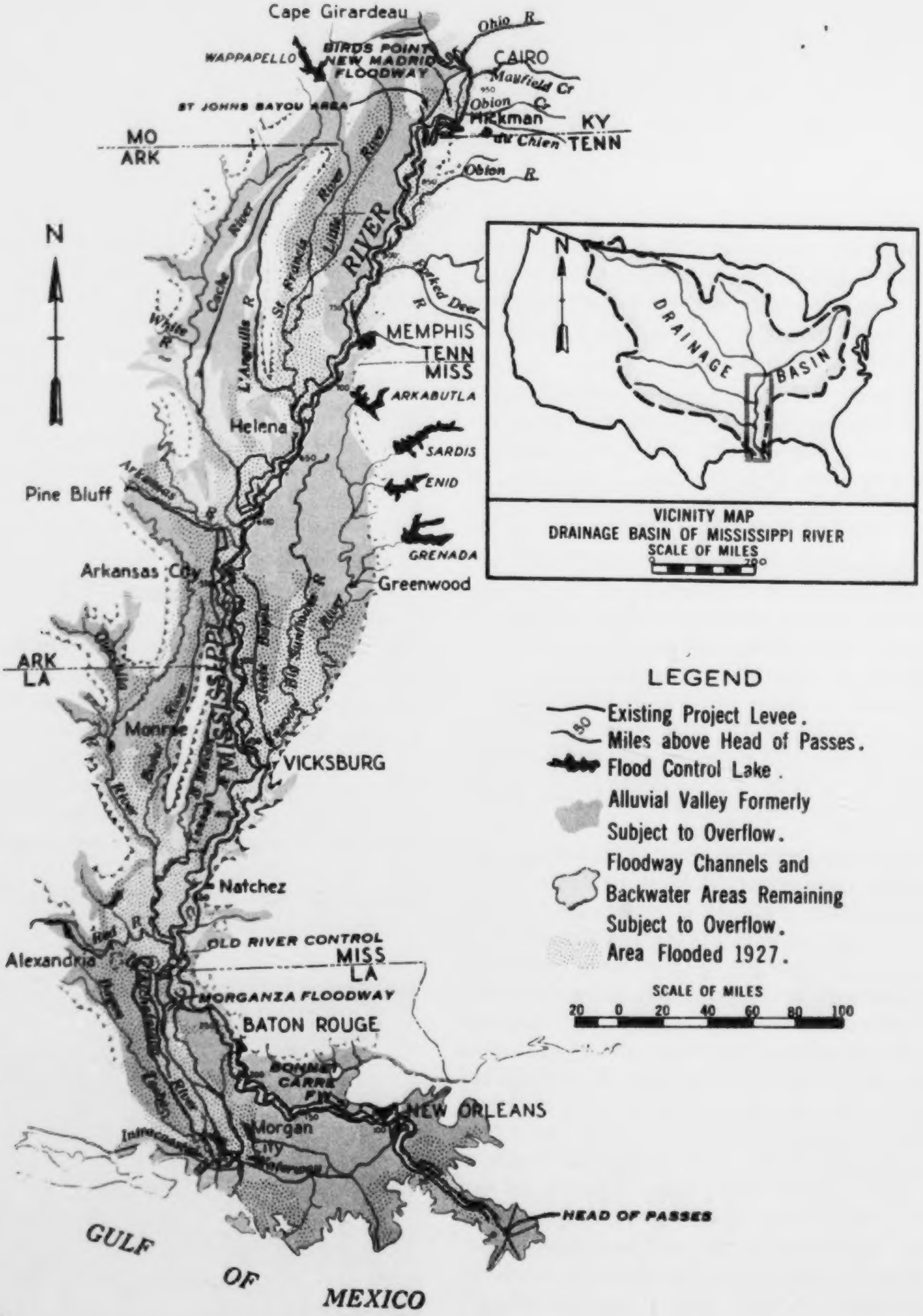
The hearings opened on November 7, 1927, and ran for several weeks. Hundreds of witnesses were heard and over 5,000 pages of testimony was taken. The Chairman of the House Committee on Flood Control, Frank R. Reid of Illinois, stated that the objective of the hearings was to change a policy that had existed for 150 years – expansion from Federal aid to absolute Federal flood control. Almost every witness reflected this position – that flood control on the Mississippi River was a national problem to be solved by the national government.

While the flood control hearings were underway in Washington, General Jadwin spoke to a Mississippi Valley Improvement Association convention at St. Louis. While presenting very little specific information, he outlined the overall plan which the Engineers expected to recommend to Congress. This plan included strengthening of the levees, and more bank protection, spillways, and floodways. Jadwin rejected many of the previously proposed schemes as too visionary.

> We do not want to dig enormous channels half way across the continent through mountain ranges to pump through pipe lines over 2,000,000 feet of water per second from Cairo, Ill., to the Gulf of Mexico. Many plans that are frequently mentioned must be discarded either because the cost is out of proportion to the benefits, too much good land would be sacrificed, and because of the length of time necessary for their accomplishment and their uncertainty as to their results and effects.[5]

Included in the rejected plans were dredging the bed of the river, dredging side channels, a wholesale moving back (away from the river) of the levees, straightening the channel, clearing the land to provide a floodway, and reforestation. General Jadwin went on to say that the national government should increase its proportion of the cost of providing protection and many flood control advocates were dismayed by this statement. Leaders in the Mississippi Valley were of the opinion that flood control legislation would be a failure so long as it was contingent upon local contributions.

General Jadwin submitted his recommendations on December 1st, 1927 and his plan recommended a fundamental change from the past. Since its creation, the Mississippi River Commission had rejected every attempt to change its "levees only" policy. General Jadwin's report repudiated the "levees only" theory of flood control on the Mississippi River. During flood times, the Mississippi River developed sixty million horsepower and Jadwin's assumption was that such power could not be controlled. Heretofore, flood control on the Mississippi had consisted of raising the levees higher and higher as new flood heights were reached. It was Jadwin's contention that the cost of building levees to hold back a flood like that of 1927 would be prohibitive. Larger levees would also lead to the possibility of greater disasters in failure.


Cape Girardeau
Ohio R
CAIRO
BIRDS POINT NEW MADRID FLOODWAY
WAPPAPELLO
Mayfield Cr
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ST JOHNS BAYOU AREA
Hickman
Bayou du Chien
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TENN
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ARK
Obion R
RIVER
Little River
St Francis R
Cache River
White R
L'Anguille R
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Forked Deer R
MEMPHIS
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ARKABUTLA
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Greenwood
ARK
LA
Monroe
MISSISSIPPI
VICKSBURG
Natchez
Red R
OLD RIVER CONTROL
Alexandria
MISS
LA
MORGANZA FLOODWAY
BATON ROUGE
BONNET CARRE FW
NEW ORLEANS
Morgan City
Intracoastal Waterway
HEAD OF PASSES
GULF OF MEXICO
DRAINAGE BASIN
VICINITY MAP
DRAINAGE BASIN OF MISSISSIPPI RIVER
SCALE OF MILES
0
200
LEGEND
Existing Project Levee.
50
Miles above Head of Passes.
Flood Control Lake.
Alluvial Valley Formerly Subject to Overflow.
Floodway Channels and Backwater Areas Remaining Subject to Overflow.
Area Flooded 1927.
SCALE OF MILES
20 0 20 40 60 80 100

ALLUVIAL VALLEY OF THE MISSISSIPPI RIVER

The recommended plan differed from the past in that it limited the amount of flood water carried in the main river to its safe capacity. Any surplus water would be channeled through lateral floodways.[6]

General Jadwin's plan contemplated a spillway above New Orleans, diversion floodways in the Atchafalaya and Tensas Basins, a floodway from Cairo to New Madrid, and an overall strengthening and a moderate raising of the levees. Included in the plan was the setting back of the levees on the main river at various bottlenecks to increase the carrying capacity of the river[7] in those reaches. A program of dredging and training works were designed to improve navigation. Extensive revetment of the banks was recommended to reduce the danger of attacks on the foundation of levees and their destruction by caving banks. He placed the estimated cost of the project at $296,400,000.[8]

After detailing his own plan, Jadwin discredited all other suggestions for flood control. Side channels were rejected as too costly and would silt up rapidly. Such a channel, for example, from Cape Girardeau to the White River would cost $337 million and the same amount of water could be carried by simply increasing the levee size at a cost of only $27 million.[9] Cut-offs were rejected because the results would be too uncertain. Jadwin recommended adhering to the policy of maintaining the river channel as it was at the time. Reservoirs were rejected as not being applicable to the Lower Mississippi. A study had revealed that 203 headwater reservoirs at a cost of more than $1.3 billion would result in only minor reduction of river stages. The same protection could be provided for by levees and the cost was estimated as only one-fourth that of reservoirs.[10] "Levees only" was rejected because the increase in heights would bring about more crevasses and involve many foundation difficulties. A "levees only" plan would cost more than $556 million.[11] The most controversial aspect of the plan involved a contribution of one-third of the cost by local interests. Since the Flood Control Act of 1917, local interests had been required to contribute a third of the cost of levee construction, and private interests had been unable to sustain that proportion.

On December 8th, 1927, President Coolidge submitted the Jadwin plan to Congress with the recommendation that appropriate legislation be enacted. It was Coolidge's position that local interests should provide at least twenty percent of the costs and that while the entire nation would be paying for flood protection (tax dollars), only a small part of the nation would receive any benefits. It would be revolutionary, he felt, for the Federal Government to fund 100 percent of the costs. Nevertheless, Coolidge

stated that "the Federal Treasury should bear the portion of the cost of engineering structures for flood control that is justified by the national aspects of the problem and the national benefits."[12]

Reaction to the Jadwin plan and Coolidge's letter of transmittal was spontaneous and critical. Still, Coolidge refused to recommend complete government funding. Even though the flood of 1927 had caused great damage at the expense of local interests, Coolidge would not retreat from his original position.

> But it is extremely important that it (local interests) should pay enough so that those requesting improvements will be charged with some responsibility for their cost and the neighborhood where works are constructed have a pecuniary interest in preventing waste and extravagance and securing a wise and economical expenditure of public funds.[13]

Criticism of the Coolidge's statements came from both influential leaders and Valley newspapers. An editorial in the *Commercial Appeal* was typical:

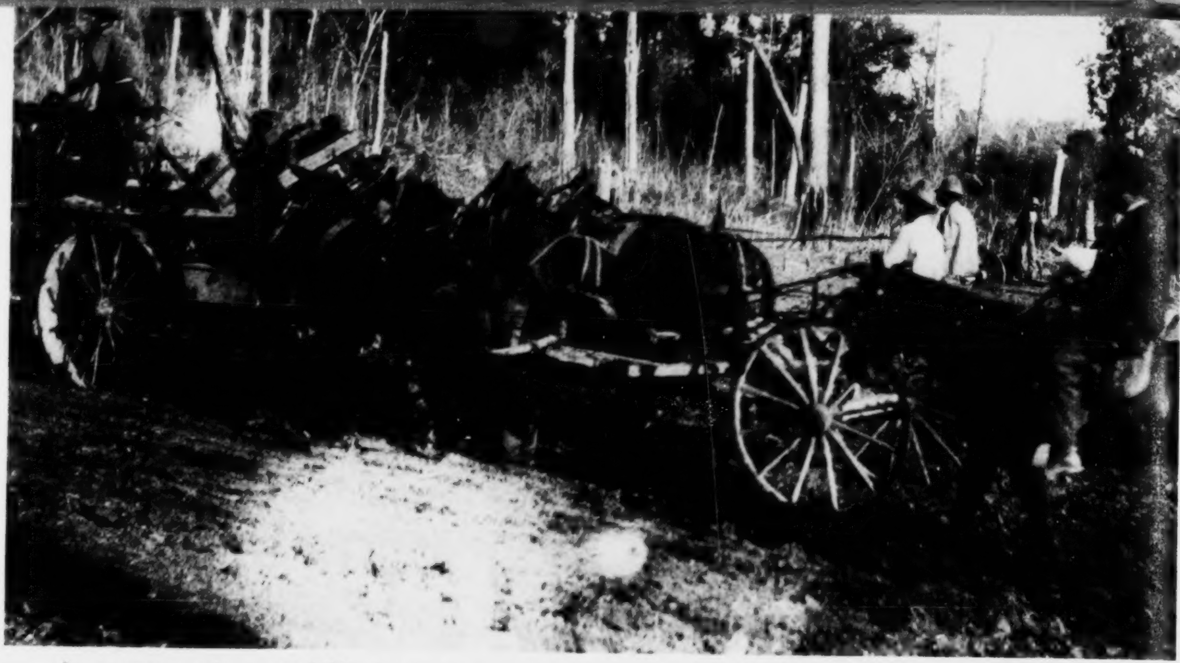
> The President's message to Congress is the attitude of a provincial mind couched in the language of rural New England. It is so reactionary it is radical.[14]

After summing up the arguments for complete funding, the paper concluded that:

> The President's attitude toward flood control is so cold and so lacking in sympathy that it cannot be accepted as a national viewpoint. The rest of the country surely does not share his views.[15]

In Congress, the features of the Jadwin plan came under fire. Senator Hawes of Missouri characterized the plan as an effort by the Engineers to secure more power and to lessen civilian participation in the flood control program. He stated that the Engineers were attempting to handle a serious national problem without presenting the river situation in its entirety. The Senator went on to declare that the Birds Point - New Madrid floodway would mean devastation for Southeast Missouri, and would not be accepted by that state. Hawes then introduced his own flood control bill calling for the expenditure of one billion dollars, with one hundred million spent annually.[16] Senator Robinson of Arkansas also introduced another bill that provided $100 million a year until the work was completed.[17] More criticism of the Jadwin plan was voiced by the Democratic leader in the House. Finis J. Garrett of Tennessee declared that not a single recommendation contained in the Jadwin Plan contemplated any protection to the four

A rare frontal view of the "Mississippi III," usually photographed to feature the stern paddle-wheel. Length overall 220', beam overall, 38'2". Displacement 761 long tons (light). Two steam engines producing 400 IHP at 18 RPM. Speed: 12.5 mph light (still water), 10 mph loaded (without tow). The cabin was removed from the old hull and installed on the depicted hull in 1927 at Paducah, Ky.



Levee construction, post WWI. As can be seen, levee construction was yet the work of men and beasts. To the left is a mule-drawn elevating grader; to the right is a four-spot wagon, and in the right background is a wheel scraper of 1/3 yd. capacity. In the picture at lower right we see a mule drawn scraper.

counties in Western Tennessee bordering, or lying near the river. He argued that the four counties should be given protection, and if not, they should be entitled to compensation for any resulting property damage.[18]

While the debate over the Jadwin plan continued, the First and Second District began to repair the damage done by the flood of 1927. The Chief of Engineers authorized the closing of seventeen small and major crevasses in the levees.[19] During the fiscal year 1927, more than 4.6 million cubic yards of material was added to the levees. Experiments with the lapped slab concrete revetment were continued and a power-operated sinking plant designed to lay 100-foot sections of the regular concrete revetment was constructed on a steel barge. From information and experience gained from this sinking plant, two other sinking plants were constructed, but they were not finished before the high water season. During the year, over nine thousand feet of revetment was placed on the banks in the First and Second District.[20]

After the Christmas recess, the House Committee on Flood Control resumed its hearings on a flood control bill. These

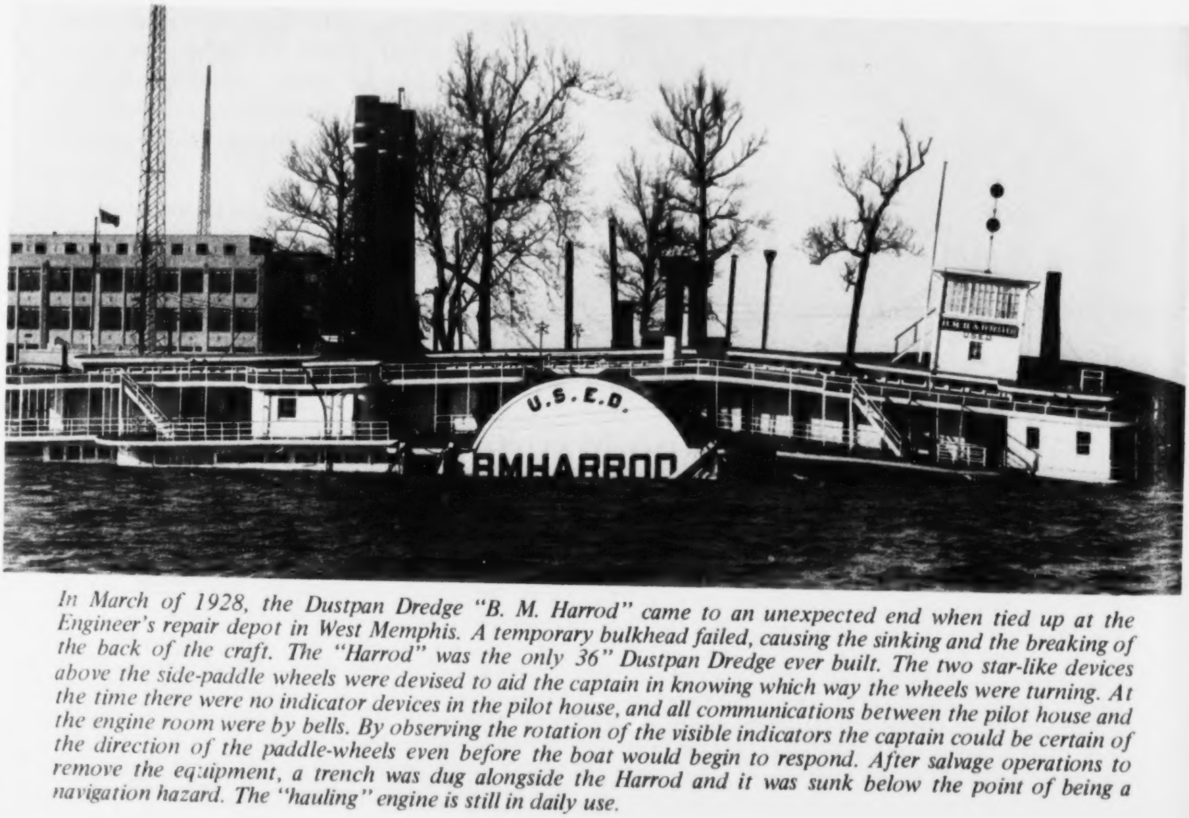
hearings centered on three proposals – the Jadwin plan, the Reid Bill, and a plan submitted by the Mississippi River Commission. The Commission plan did not depart radically from the Jadwin plan except in appropriations and the project flood. Reid's Bill contemplated appropriations of $473 million and called on the abolishment of the River Commission and substitution of a seven-member Mississippi Valley Flood Commission. This new commission was planned to have wide discretion in its choice of flood control devices.

The flood control hearings developed into a forum for those opposed to the Jadwin plan. Anton J. Cermack, Mayor of Chicago, led off the debate and warned that the Congress had better be on with the job of enacting some type of flood control bill. Cermack, in testifying for a flood control bill, stated that if Congress would appropriate as much to stop the flow of water into the Mississippi River as it had appropriated to stop the flow of wine and beer in other parts of the United States, the Mississippi Valley would be adequately protected within a short time.[21]

The mule was the major piece of "machinery" for bank and levee work up into the mid-1930's.

Colonel Charles L. Potter, President of the River Commission, testified that neither Jadwin, nor the Commission, had sufficient information to draft a comprehensive flood control plan. Governor Martineau of Arkansas also opposed the Jadwin plan and most of his criticism focused on the state contribution to the cost of flood control. The Illinois Central Railroad voiced opposition to the Jadwin plan by protesting the expenditures necessary to relocate tracks and bridges.[22]

General Jadwin's appearance before the flood control committee generated the most fireworks. Jadwin's authoritarian nature got the better part of his discretion. He testified that he alone had the authority to submit a plan for control of floods on the Mississippi, and as a result, the Mississippi River Commission had appeared at the backdoor with its plan.[23] Jadwin also took exception to criticism of his plan by Governor Sampson of Kentucky, stating that his criticism was full of fallacies. Chairman Reid of the committee asked Jadwin if the committee had the power to seek out information and requested that Jadwin step aside until he could prepare himself to respond to committee hearings.[24] Most newspapers in the Valley were critical of



In March of 1928, the Dustpan Dredge "B. M. Harrod" came to an unexpected end when tied up at the Engineer's repair depot in West Memphis. A temporary bulkhead failed, causing the sinking and the breaking of the back of the craft. The "Harrod" was the only 36" Dustpan Dredge ever built. The two star-like devices above the side-paddle wheels were devised to aid the captain in knowing which way the wheels were turning. At the time there were no indicator devices in the pilot house, and all communications between the pilot house and the engine room were by bells. By observing the rotation of the visible indicators the captain could be certain of the direction of the paddle-wheels even before the boat would begin to respond. After salvage operations to remove the equipment, a trench was dug alongside the Harrod and it was sunk below the point of being a navigation hazard. The "hauling" engine is still in daily use.

Bonnie and Clyde would have been proud. Picture taken during office picnic at Bank Protection Party, May 30, 1928.

Jadwin's behavior. A typical response was voiced by the *Commercial Appeal.* "So far as we are able to learn, this is the first time that the right of any recognized organization to appeal before a congressional committee has been seriously questioned."[25]

After exhaustive hearings, the House Flood Control Committee approved the Reid Bill and sent it to the floor for debate. The White House voiced immediate opposition to the Reid Bill. President Coolidge insisted that the House adopt the Jadwin plan. He stated that the Reid Bill failed to offer any more flood control than the Jadwin plan, although it would involve an expenditure of four and a half times as much money.[26] Republican members of the House were brought into line by the Coolidge message. The Reid Bill was to be delayed until it conformed to the views of the President.

Meanwhile, the Senate had been conducting its own hearings. Near the end of February, 1928, the Senate Commerce Committee sent the Jones bill to the floor for debate. The bill had been drafted by Senator Jones of Washington, and conformed to the features of the Jadwin plan.[27] Provisions of the Jones bill included $325 million for federal payment of construction costs, but left to a commission the determination of just how much local interests should pay. The bill recommended the creation of a three-member commission which would make the final determination on both the financial and engineering phases of the project.

From the outset there are strong opposition to the Jones bill. The opposition was led by Senator Hawes of Missouri, another who had denounced the Jadwin plan. Hawes threatened that he would add so many amendments to the bill that the original sponsors would be unable to recognize their own work. Realizing it lacked enough support, the Commerce Committee recalled the bill for revision. When revised, the bill eliminated the creation of a flood commission and put the execution of the project into the hands of the Chief of Engineers and the War Department. Jadwin's recommendations were still the basis of the bill, but few of the principles expounded by the Mississippi River Commission were incorporated into the new bill and appropriations were reduced from $472 million to $400 million.[28]

Senate approval of the Jones bill came on March 28, 1928, by a vote of 70 to 0.[29] Appropriations carried in the bill had been further reduced to a total of $325 million. The Jones bill was quickly sent over to the House even before that body had made up its mind whether to consider the measure or one of its own drafting. Without radical changes, the House Committee on Flood Control then adopted the Jones bill as a basis for House action.[30] President Coolidge called the House action the most vicious piece of porkbarrel legislation ever devised by Congress and it was rumored that Coolidge would veto the bill if changes were not made.[31] Representative Strong of Kansas led the opposition in the House, calling the Jones-Reid Bill corrupt and declaring that "a dozen Teapot Domes" (were) wrapped up in the bill."[32]

House approval of the Jones-Reid Bill came on April 24, 1928, by a vote of 254 to 90.[33] The House had ignored a threatened veto by Coolidge. A conference committee was appointed to iron out the differences in the Senate and House bills and, after a fortnight of wrangling, produced a conference report.

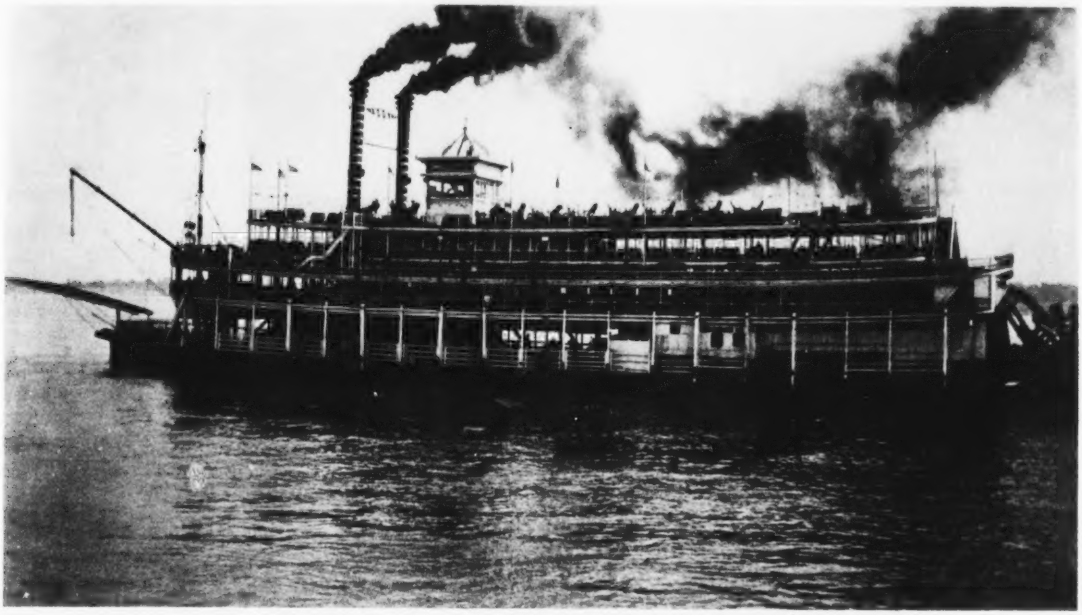
On May 8, 1928, the House gave its approval to this report and the Senate concurred the next day. President Coolidge signed the Flood Control Act of 1928 into law on May 15th.[34] Thus, the Congress and the President had approved the Jones-Reid Act, now termed "the greatest piece of legislation that ever came before a peace-time Congress."[35]

The Flood Control Act of 1928 provided for a three-member commission, consisting of the Chief of Engineers, the president of the Mississippi River Commission, and a civil engineer appointed by the President. It was the duty of this commission to decide the method of flood control to be used and no local contribution was required by law. However, states or levee districts were required to maintain all flood control works after their completion, except for controlling and regulating spillways. States of levee districts were required to provide all rights of way for levee foundations and levees on the main stem of the river between Cape Girardeau and Head of Passes, while the Federal Government was to acquire lands subject to overflow caused by the new flood control plan. Prosecution of the project was to be under the River Commission under the direction of the Secretary of War and supervision of the Chief of Engineers. The act also provided for surveys of the tributaries of the Mississippi with a view to providing protection to these areas.[36]

President Coolidge selected Carleton W. Sturtevant as the third member of the commission that included General Jadwin and Colonel Charles L. Potter, President of the River Commission. This commission was to decide the merits of both the Engineers plans and the other plans and then report their findings to the President. With Sturtevant being an old acquaintance of Jadwin, Colonel Potter voiced the only opposition to the Jadwin plan. In early June, 1928, Colonel Potter was replaced on the commission by Colonel Thomas N. Jackson.[37]

In the meantime, the Mississippi River Commission was reorganizing the Districts under its control to promote efficiency of operations in the new comprehensive project. To begin, the Commission itself prepared to relocate from St. Louis to Vicksburg and be more centrally located. The First and Second Engineer District was reorganized and consolidated with the Dredging District into its present title, the Memphis Engineer District. The Memphis Engineer District encompassed a vast territory, extending from the Mississippi into parts of Texas, New Mexico, Oklahoma, and Kansas, as well as Illinois, Kentucky, Missouri, Arkansas, Tennessee and Mississippi. The scope of projected activities proved to be so great that new facilities were needed, and, by 1932, the offices of the district were moved to a new office building just completed at the Supply and Repair Depot reservation. Located on the Arkansas side of the River across from Memphis, the operation was symbolically located within the floodway and was protected from high water by a levee palisade. This was the first "home" owned by the engineers, previous spaces being but rented offices in various buildings. The 9-acre tract of land had been purchased in 1903 as a base of operations for the repair of dredging equipment. It had been used exclusively by the Dredging District until the consolidation into the Memphis District. This site would be home to the new Memphis District for over thirty years.

In June of 1928, the three-member River Commission, now chaired by General Jadwin,

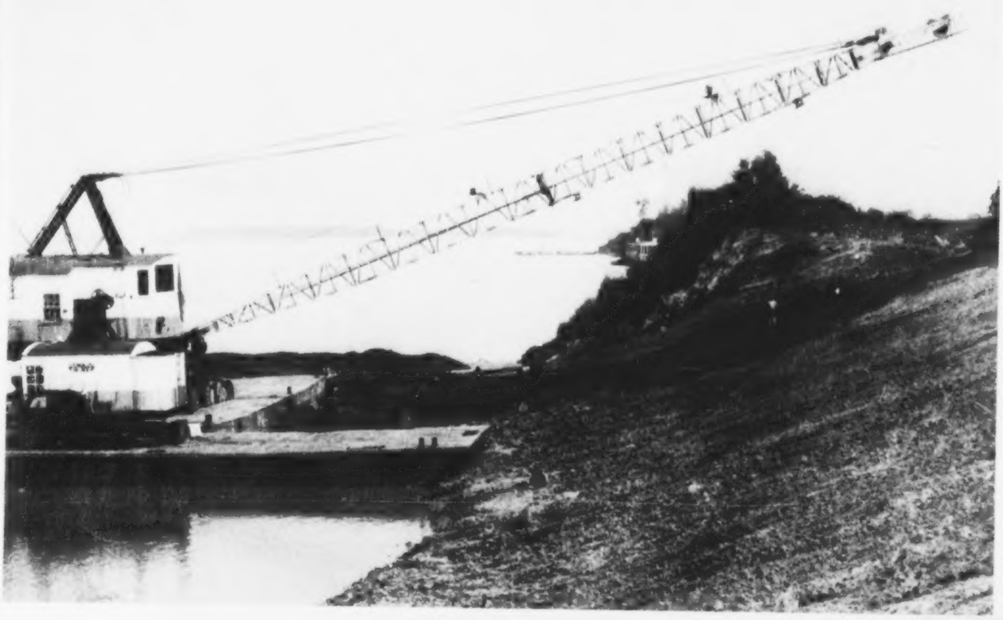


The "Majestic" was a familiar sight to the River watchers.

made its inspection voyage on the River. By July 20th the commission had finished its survey of the river and begun preparing a report. The commission submitted this report on August 8, 1928, and it presented no surprises. General Jadwin had dominated the commission and his plan was adopted with little change.

The plan from Cape Girardeau to the mouth of the Arkansas River called for raising the levees from zero at Cape Girardeau to two feet at Birds Point. A floodway from Birds Point to New Madrid, about five miles wide and capable of carrying about 450,000 cubic feet per second, would protect Cairo. The elevation of the levee of the floodways was to be 60 feet on the Cairo gage at the upper end and 52.5 feet on the New Madrid gage at its lower end. Fuse plug levees would be constructed at each end to an elevation about five feet below the grade of the setback levee. In addition, the levees from New Madrid to the Arkansas River were to be raised to protect against a superflood equivalent to 66 feet on the Cairo gage (if confined). These were the essential features of the plan in the First and Second District. For the rest of the Lower Mississippi the plan called for raising the levees, spillways and floodways below Red River, and a channel stabilization program for the entire river.[38]

As a result of the Flood Control Act of 1928, the Mississippi River Commission was reorganized and its policies were changed. A "levees only" policy was abandoned and the policy pertaining to navigation was modified. In 1896, the River Commission had concentrated on dredging as a means of keeping an adequate channel open and, from that date until 1928, the only regulation works constructed were those designed to close chutes and secondary channels. In 1928, the Commission adopted a policy of river regulation by the systematic construction of contraction works.[39]



Here Bank Grading Party #12 is grading and preparing a slope for revetment.

Bank grading Party #12, beginning the endless task of repairing highwater damage.

With the 1928 Flood Control Act, operations in the First and Second District were expanded.

In early June, 1928, the Secretary of War announced the funds that would be available under the flood control act. The mainline levees received $8.4 million. No time was lost by Memphis Engineer District in dispatching employees to the upper reaches of the district to survey the best route for the setback levee of the Birds Point - New Madrid Floodway. Eleven contractors were awarded almost $3 million worth of levee construction. In the reorganization commotion, however, only about 3.5 million cubic yards of material was added to the levees during that fiscal year.

During 1928, the Memphis district continued a revetment program with both fascine and lapped concrete slabs. The district placed 5,800 linear feet of the 4"x6'x11' slabs on the banks. In addition, over 10,000 linear feet of the fascine revetment was constructed and two power-operated sinking plants for the concrete revetment were built. This was the first year that the plant was available for any substantial revetment work. A new concrete mixing plant was also under construction and the engineers had developed a new form for the concrete slab plus a new method of casting slabs. This new technique resulted in the revetment crews doubling the output of slabs.[40]

As the year 1929, began, the Mississippi River Commission reported that the new flood control project was five percent complete and that they expected to finish another ten percent before the year was over. Even though work was well underway, opposition to the Jadwin plan was still strong. Most of the opposition focused on the spillways and floodways. Many believed that the floodways would take good land out of production and the owners would receive only one price for their land. On the other hand, the land could produce crops for many years and determination of its value was vague.

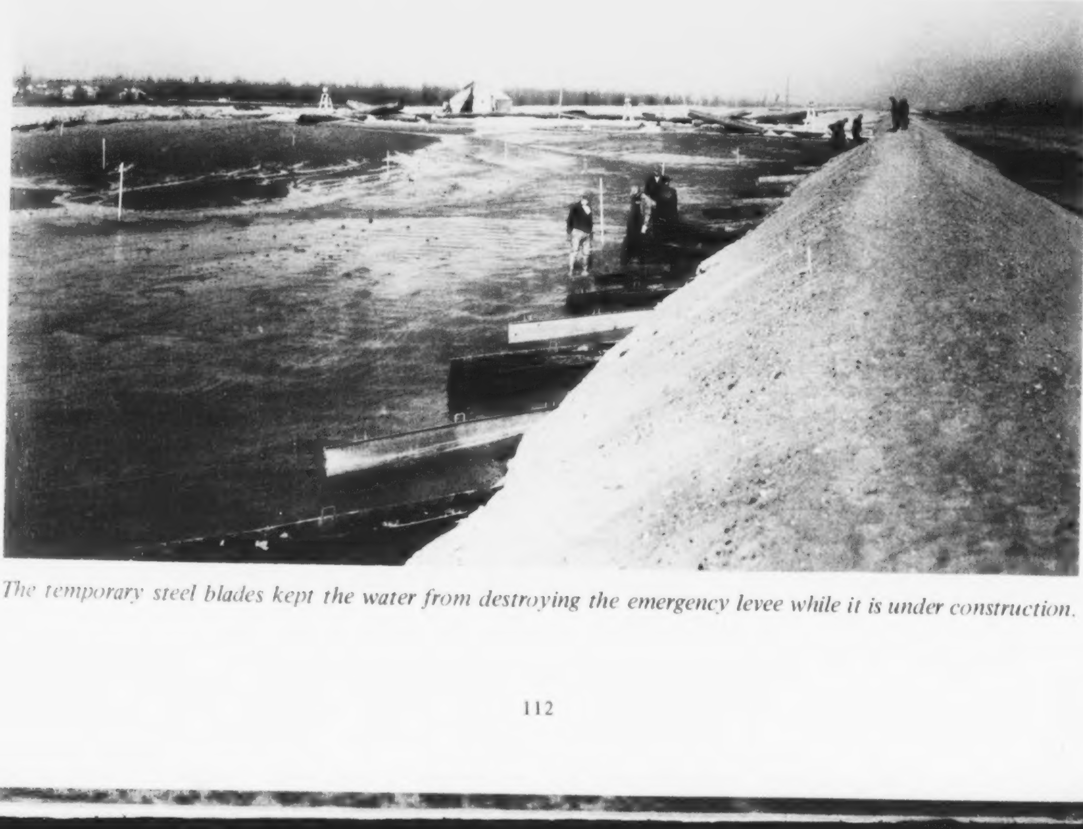
A group of congressmen called on President Hoover to revise the plan. They informed the President that, unless the plan was altered, litigation would tie up the project for several years. A committee of the American Engineering Council then denounced the Jadwin plan and declared that the three member commission appointed to adjust the engineering differences of the Jadwin and River Commission plans should have been called "Jadwin, Jadwin, and Jadwin,".[41] While 20,000 men continued work on the project, the engineers now began receiving criticism from both sides. Chairman Frank Reid of the House Flood Control Committee, a project supporter leveled a blast at the Corps for not speeding up work. Reid called upon the President to scrap the Jadwin plan if they were not going to get on with the work.[42]

In the midst of growing opposition, District Engineer Wilby began his first phase toward construction of the Birds Point - New Madrid Floodway. A topographic survey, together with various examinations and hydraulic studies, was made and, in April, 1929, Wilby invited bids for the construction of the levee. It was hoped that the project could be completed by December, 1931. Then an injunction restraining Wilby from accepting the bids was filed in Federal Court at Cape Girardeau. The injunction was asked for on the theory that the property owners had not been justly compensated for private property taken for public use. In June, 1929, the Federal Court refused to issue an injunction.[43] A second unit was filed but it was also dismissed. A meeting of the Mississippi River Flood Control Association in Memphis called upon President Hoover to halt work on the floodway, but at the same time, it wanted the rest of the project carried to conclusion.

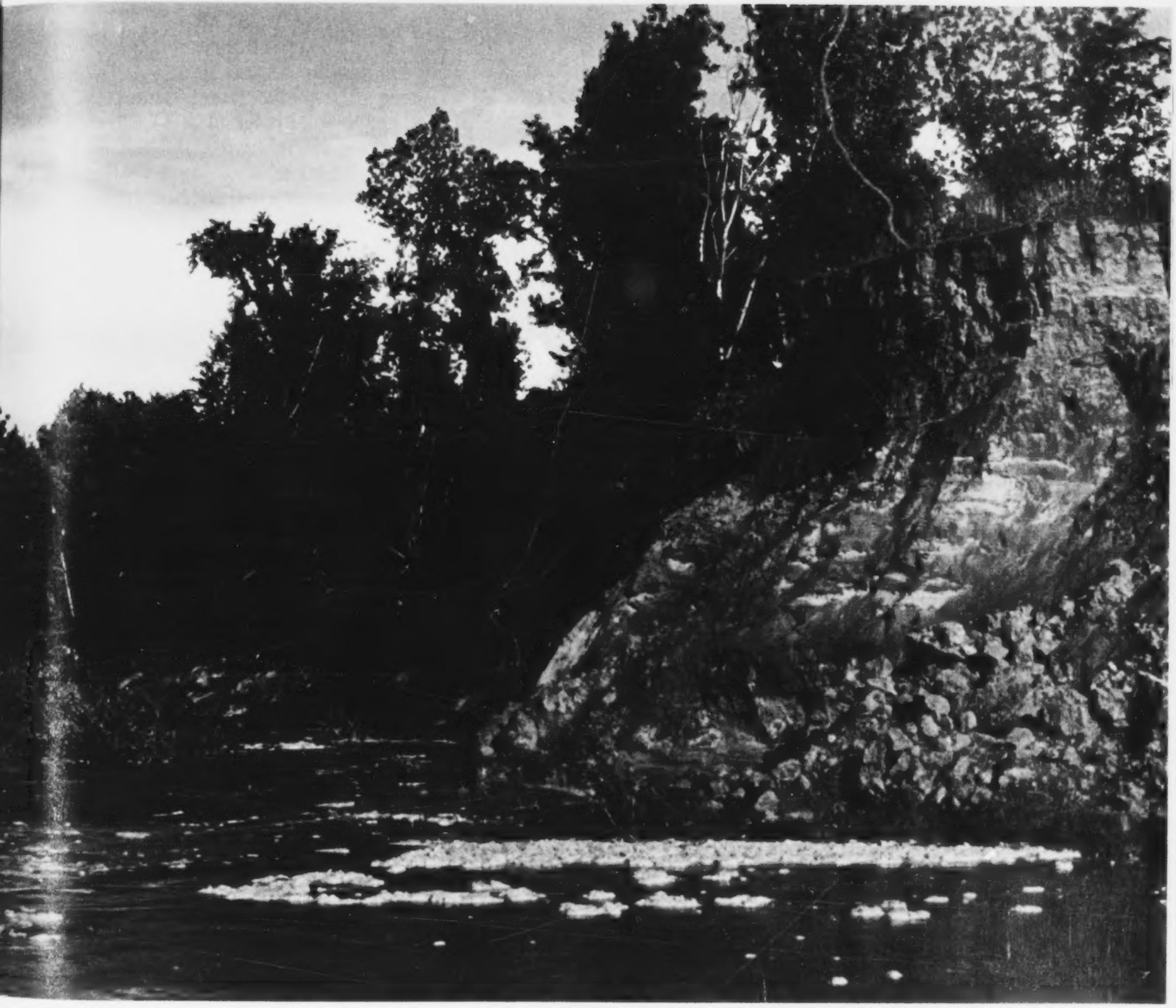
In June, 1929, General Jadwin authorized the Mississippi River Commission to offer compensation amounting to approximately $2.5 million for flowage rights on the estimated 130,000 acres inside the proposed floodway. The policy of the Engineers' of compensating property owners by the purchase of flowage rights was upheld by the Attorney General of the United States.[44] In late July, 1929, the first bids on the project were received but had to be rejected because they were too high. New bids were invited, and, in late August, Wilby finally accepted a low bid on about five miles of the levee. This action was approved by the Chief of Engineers.[45]

Levee construction throughout the district was hampered by the attitude of the levee contractors. They were unhappy about the way levee contracts were awarded and a large delegation went to Washington to ask General Jadwin's support of their position. They contended that government engineers submitted bids along with the private firms, the work going to the lowest bidder, whether it was the government or a levee construction company. This was not entirely true, because the government's estimate had to be twenty-five percent lower than any bids received before being allowed to do the work.[46]

In 1928, the Mississippi River Commission had also adopted a new grade and section for the levees. During 1929, the Memphis Engineer District placed a little over six million cubic yards of material on the levees. Because of the great amount of work done, the levees were now fifty-six percent complete. This massive addition to the old system was because of new grade and section, which required that the levees contain more material than had been projected before 1928.[47]



The temporary steel blades kept the water from destroying the emergency levee while it is under construction.



This picture shows why so much of the River bank is now protected by paving. Caving banks not only represent the loss of arable soil, they present a navigational hazard of floating debris and a channel obstruction from increased sediment.

Revetment of caving banks was an important part of the new flood control project. Caving banks were a menace to the levees, private property, and navigation. Illustrative was the stretch at New Madrid Bend. Between 1912 and 1929, caving banks at this bend had carried 1,500 acres of good land into the river at an estimated damage of $150,000. The largest cave-in at one time was 3,200 feet.[48] Navigation was threatened by caving banks because of the trees that became snags and because the material that fell into the river added to the sand bars. The flood control project recognized this danger and provided for an expanded revetment program. The amount of revetment the Memphis District placed on the banks in 1929 was indicative of the new project. Almost 43,000 feet of revetment was placed at eleven locations. Experiments with lapped-slab concrete revetment were continued by the laying of almost 13,000 feet of this revetment at Reelfoot, Bend of Island No. 8, and at Slough Neck Landing.[49]

The expanded flood control project also had other benefits to the residents of the Valley. In 1929, Colonel F. B. Wilby, District Engineer, announced that the district would offer positions to seventy-five civil and mechanical engineer graduates. He proposed to employ some of the men as student laborers and sub-foremen on construction work, and others as inspectors on levees and revetment work. The future engineers would receive valuable experience and would be paid at the same time.[50]

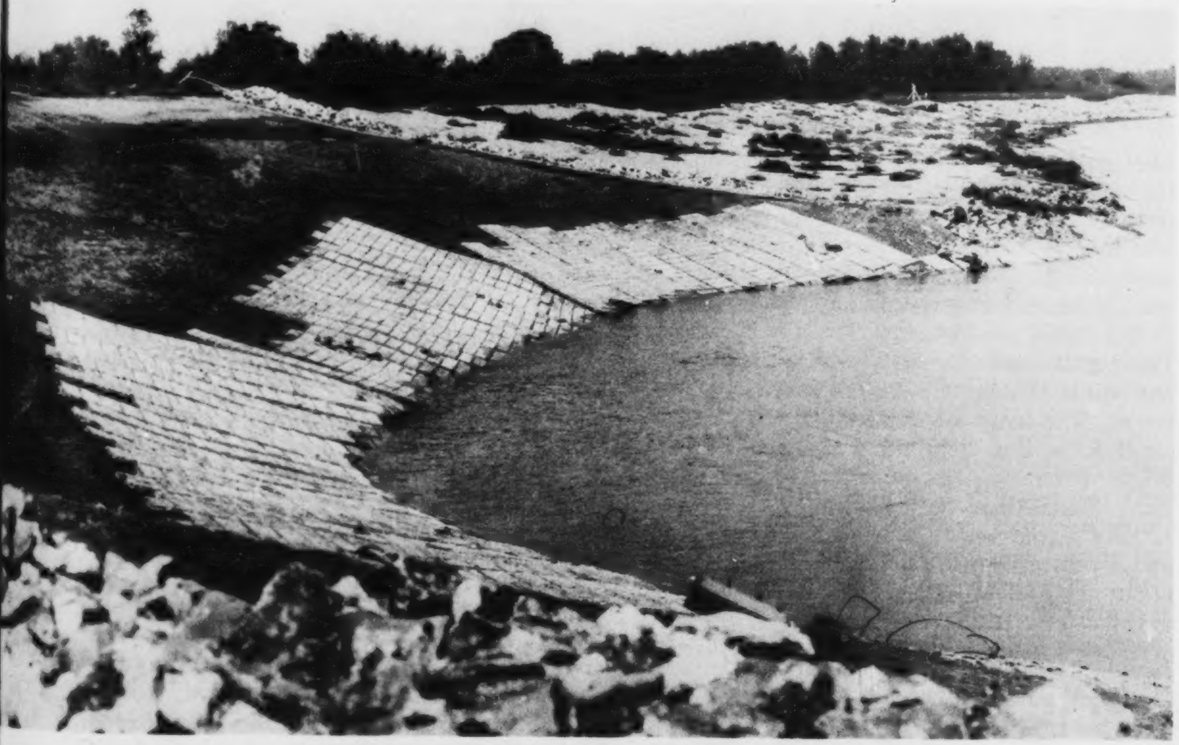
High stages of the Mississippi River presented several problems for the Memphis Engineer District in 1929. The flood of 1929 did not produce excessively high stages, but was significant by its duration. For ninety-one days – between March 10 and June 8 – the river was near or above flood stage in Memphis. Crest stage was reached at 41.5 feet on May 22, not in itself significant, but it remained at this stage for seven days. Water against the levees for such extended periods cause saturation of the levees and leave them subjective to failure. Floodfighters in the Memphis District experienced several tense moments before the flood waters receded.[51]

On March 10, the river went above the flood stage at Memphis. There was no alarm at the district headquarters because there had been little rain upriver. However, the last week of March brought heavy rains in the Upper Valley and meteorologists revised their crest stages. Continued rains caused one meteorologist to admit that there was no way to tell what the eventual crest would be.[52] Floods on the Tennessee River had already resulted in the deaths of thirty-two people and water from the Tennessee was expected to push the crest stages on the Mississippi even higher.

The first indication of trouble came on April 19, 1929. A 350 foot long pocket cave at Knowlton, Arkansas carried with it three feet of the face of the levee. The pocket cave was caused by undermining behind the revetment. Over two hundred men were sent to the area by the Memphis Engineer District in an effort to save the levee and government boats carried 50,000 feet of lumber and 300,000 sacks to the threatened break. This threatened area was the same place that had crevassed in 1927 and the location where the *Pelican* was swept through a levee break. A large mat was sunk to stop the caving and, meanwhile, the levee was strengthened with sand bags. In what was called the greatest saga of the 1929 highwater fight, the Engineers saved a large area from inundation.[53]

While the Engineers were putting the finishing touches on the levee at Knowlton, a private levee a little to the south of Laconia Circle crevassed on April 22nd. Eight feet of water had been against the levee for two weeks. Local interests, with the help of the Memphis Engineer District, had been working several weeks on the levee trying to save it, but it broke without warning. The crevasse widened to about 350 feet and caused the flooding of about 12,000 acres to a depth of eight feet.[54]

Another victory over the flood waters by the Engineers came at Reelfoot. Caving at this point had been creeping slowly toward the levee. Construction of a loop levee had been underway for several months, but – at the time – there remained a gap of 150 feet that had not been closed. Three hundred men and two levee machines were working in a race to



Reelfoot Front bank repairs, showing riprap and articulated mat.

Man on horseback patrolling Mississippi River levee in the Laconia Drainage and Levee District. Condition of levee shows why the Jadwin Plan specified that mainline levees would be brought to height and grade specifications by the Engineers. In contrast, modern levees are kept free of trees and brush, and are topped with gravel roads for access to trouble spots.

close this gap before the caving took the levee with it. The caving started taking the face of the levee and, on a sixty foot section, left only one-sixth of the original levee standing. Through frantic efforts by the Engineers, the gap in the loop levee was closed just before the outside levee was destroyed.[55]

Though the levees were heavily patrolled, the district engineer, as always, had to contend with people who would dynamite the levees. One such incident occurred south of Marked Tree, Arkansas. A section of the levee was dynamited and the Memphis Office had to use 5,000 sand bags to close the break.[56] Levee guards were ordered to shoot and kill if any other attempts were made to cut the levees. The only other trouble spot was a small levee that held the backwater of the White River. District personnel, along with local officials, had been working for a month to save a fourteen mile levee that protected about fourteen square miles. They had sacked about 3,000 feet of levee and were holding two feet of water before the levee broke. The crevasse widened to about 450 feet before it was closed.[57]

Other engineer districts along the river had similar troubles with the levees. At Mounds Landing, Mississippi, there was an incident involving the President of the United States. President Hoover had banned the use of convict labor on government projects. At Mounds Landing, sloughing had placed the main levee in great danger. Although 400 men were at work on the levee, local officials needed additional labor and requested convict labor but Hoover refused to budge on the issue. At the time, one source said that one convict was worth more on that type of work than two conscripted laborers and he went on to say that "another executive order should be issued. It should provide in case of emergency the War Department and the Army Engineers abandon their traditional stupidity in the treatment of Mississippi River problems."[58] The whole matter was resolved when both government and civil engineers agreed that the danger to the levee had passed.

As a result of the flood of 1929, more than 841,000 acres were flooded and about 138,000 persons were forced from their homes. The flood of 1929 had become the largest ever to pass down the river without a serious break in the levees and about $375,000 had been spent by the River Commission in fighting the flood.[59] Even though the new flood control project was just getting underway, it had obviously shown its worth.

Controversy over revision of the Jadwin plan continued throughout 1930. General Lytle Brown, who had replaced Jadwin as Chief of Engineers, made an inspection tour of the project in January, 1930. Stopping in Memphis, General Brown said that the levees had materially reduced the danger of flooding and that litigiation, not money, was the greatest drawback in the completion of the project. Moving on to New Orleans, General Brown revealed that there might be some revision of the Jadwin plan to include reservoirs on both the White and Arkansas Rivers.[60]

Two years after the project had been adopted, more than $66 million had been expended. Nevertheless, the opponents of the Jadwin plan refused to concede defeat, and, in the summer of 1930, the House Committee on Flood Control conducted an inspection. Jed Johnson (D. Okla.) was especially critical, believing that the congressional committee had been fed false information. After conclusion of the tour, the committee was of the opinion that some revision of the plan was necessary. General Thomas H. Jackson, President of the River Commission, defended the project and said that there was no justification to deviate from the Jadwin plan. Jackson, for example, totally rejected the idea of a system of reservoirs to reduce the acreage necessary to construct the floodways and spillways.

The Great Depression hit the Valley in 1930, bringing with it its accompanying misery. But the depression proved to be a boon to the flood control project. President Hoover announced that the entire $35 million appropriated for fiscal 1930 would be spent in the first half of the year and that another $35 million would be asked for the second half of the year.[61] It was hoped that this increased expenditure would relieve the unemployment crisis. That year, the Memphis Engineer District spent an average of more than a million dollars a month on flood control work and navigation improvement.

The major problem to the Memphis District Engineer was that the district could not spend much of the money where it was needed – on the Birds Point - New Madrid Floodway. Landowners inside the floodway were being obstinate about giving flowage rights through the floodway. Seeking to expedite the construction, the War Department asked the Attorney General to institute condemnation proceedings to secure the flowage rights. Six months later condemnation proceedings involving 87 suits for a right of way for the floodway levee and 650 suits for flowage rights were underway. Colonel Wilby, District Engineer, justified the Corps action by saying that "it is not necessary to defend the integrity of the Corps of Engineers. Our decisions are guided by the West Point motto: Duty, honor and country."[62]

A Federal Court appointed a six-member commission to determine damages for the setback levee right of way. Here the commissioners reported on seventeen cases involving 640 acres. They estimated the damages at almost $332,000, and the acreage involved was only one-third of the acreage required for the floodway site, without taking into consideration the land between the levee and the river where damages would be determined by other suits. The government filed an exception to the commissioners ruling and General Lytle Brown, Chief of Engineers, said the Corps was prepared to fight a legal battle all the way to the Supreme Court rather than compensate land owners for flood rights. It was the contention of the government that the damage fixed by the commissioners was fourteen times the assessed valuation of the acreage. The commission had awarded damages that would amount to more than $3,000 an acre, when the assessed valuation ranged between $20 and $40 an acre.[63] Despite these delays, the Memphis district completed eighteen miles of the setback levee during 1930.

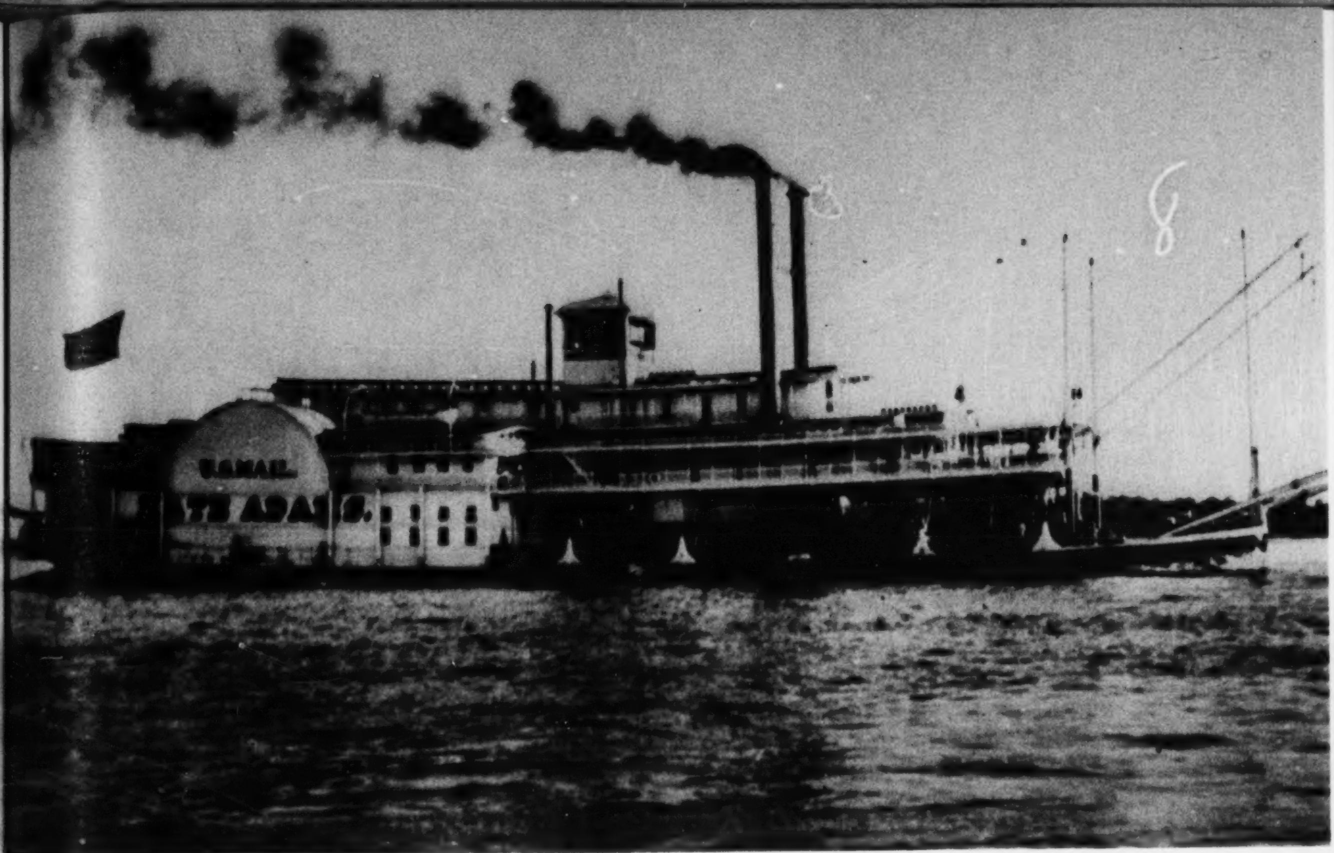
The depression gave impetus to construction of levees. In an effort to get more work, the levee contractors began to cut prices. Construction cost of levees went down to fifteen cents per cubic yard from an average of twenty to twenty-five cents a yard before adoption of the flood control project. Levee construction during 1930 amounted to more than 12.4 million cubic yards. In addition, several thousand cubic yards of material was placed on the tributary levees to repair damages caused by the flood of 1927. Of the more than 556 miles of levee in the Memphis Engineer District, about fifty-six percent of the levees were, at this time, complete.[64]

During 1930, the Memphis port handled 1,547,301 tons of freight valued at more than $81.3 million.[65] However, since 1927, caving banks were again threatening the harbor facilities. In 1930, another revetment program was begun in the Memphis harbor. The initial works involved a 2,000 foot willow mattress. Once the banks had been stabilized, the city planned to construct a boulevard along the riverfront and, today, the end result of that project can be seen as a beautiful parkway known as Riverside Drive.[66]

Bank revetment work within the Memphis district continued to expand. Each year the district moved more and more toward the use of concrete and further away from the use of the willow mattress. About a third of the revetment placed during 1930 consisted of the lapped slab concrete. At ten locations in the Memphis district more than 42,000 feet of revetment was placed. A little over 16,000 feet of the lapped slab revetment was used. In 1930, the Memphis Engineer District went into a program of contraction works. A part of the contraction work was designed to protect the river banks, but most of it was an effort to control the channel of the river. During that year more than 11,000 feet of permeable crib and pile dikes were constructed.[67]

Dredging operations in the Memphis district were also expanding each year. Most of the dredging was conducted at crossings that had been presenting a recurring problem year after year. During the low water season of fiscal 1930, the dredging fleet operated at thirty-two crossings. Seven dredges moved more than five million cubic yards of material. Dredging in the harbor at Memphis, another annual affair, consisted of moving more than 400,000 cubic yards at a cost of $33,000. Near the Supply and Repair Depot, across the river from Memphis, a dredging program was carried out with the object being to place the spoil on the reservation. This was done to build up the area and protect it from high water.[68]

The expanded dredging program also included a system of frequent surveys of river crossings and the marking of a channel line at the crossings by buoys. This program resulted in less navigation problems than in years of even lower water stages.



The second of three vessels named the "Kate Adams." Catering to passenger trade, all of the "Kate Adams" featured luxury appointments for the affluent, and dependability for the poor.

A less glamorous, but still essential part, of the navigation program was the removal of snags and wrecks. Snagging was an annual program designed to remove any hazards to navigation. Like the snags, a sunken steamer or barge offered a threat to navigation, therefore, they had to be removed from the river or placed where they presented no danger. In 1930, the Memphis district expended $18,000 removing the wreck of the steamer, *Emma III*, sunk in 1870. Sunken barges presented the same problem. Barges that sank in the river were generally left in the river. To eliminate the hazard, a dredge would excavate a large trench under the sunken barge so it could slide into the trench and be eliminated as a hazard.[69]

Flood water from the Mississippi presented no problems for the Memphis district in 1930 but high water in the tributaries caused some flooding. The most serious problems were on the St. Francis River. In January, 1930, the St. Francis broke through the levees at five places. There was one break below St. Francis Town, two breaks west of Kennett, one break below Kennett, and one crevasse above Nimmons. Flood waters from Big Lake and Little River forced many families from their homes. About 50,000 acres were flooded and more than 500 families were affected by the flood.[70]

In 1931, several members of Congress were still attempting to bring about a revision of the Jadwin plan. By the end of that year, the project was more than a year ahead of schedule and it was felt that any major revision of the plan was likely to meet with failure. Litigation over flowage rights was a sticky problem, but in general the flood control project was being pushed with vigor. Cheaper labor and declining cost, because of the economic depression, had enabled the River Commission to get more than ususal for each dollar expended on flood control. The project was providing thousands of people with jobs in a time when the job market, for all practical purposes, was closed. At the height of the work season of 1931, the Memphis district was employing more than 7,500 men on flood control and navigation works.

Some of the employees thought they were working too much. The personnel section of the district had issued orders that employees should work on Saturday afternoons and Sunday if necessary. A small uprising among the employees of the Engineers occurred because they believed that they were not being paid for the extra work. They thought the work illegal because Congress had enacted a law declaring Saturday afternoon an official holiday for employees of the engineer department. Major Brehom Somervell, District Engineer, blunted the protest by declaring "we are paid to do a job and paid well. If they don't want to work for Uncle Sam, let them get out and work somewhere else."[71]

Because of the depression, work continued at an accelerated pace. But in some levee districts, the effects of the depression were beginning to surface. The Lower St. Francis Levee District was especially hard hit by the economic downturn and most of the levee work being done by this levee board. Members of the board told the River Commission it was next to impossible to collect the levee tax. The average citizen could not pay and the railroads refused to pay. About 600 miles of railroad in the district had not paid their taxes in three years and the railroads had gone to court maintaining that their assessment was not equitable.[72] Early in 1931, the levee board had declared that a penalty of twenty-five percent on approximately $157,000 in levee taxes in the district, would be set aside until further notice because of the depression in the district caused by both a drouth and cheap cotton.

New material placed on the levees in the Memphis district during 1931 amounted to more than 19.5 million cubic yards.[73] Small amounts of work was done on the tributary levees to repair damages caused by the 1927 flood. Several contractors were awarded for construction on the Birds Point - New Madrid Floodway and, by the middle of 1931, the floodway was 77 percent complete and a program to obtain flowage rights was being vigorously prosecuted.

Crevasses had been a major problem with levees constructed in previous years, but now it was believed the levees were capable of holding back the greatest possible flood. Between the years 1880 and 1931, there had been ninety-two Mississippi River Levee crevasses. Their aggregated total came to more than 124,000 feet. There had been no major crevasses between 1893 and 1897; between 1897 and 1903; between 1903 and 1913; between 1913 and 1916; and between 1922 and 1927. Since 1927 there had been no crevasses at all in the main line levees.[74]

The serious problem of caving banks was a result of more than simply bank saturation and sloughing. Currents attacking the soft materials composing the bed and banks of the stream were washing them away and causing the banks to fall in. Even so, the greatest damage to banks was being caused by the scouring out of the bottom of the river. Scouring left the banks too steep and undermined them until they fell into the river by their own weight. This caving was greatest during falling stages and the River Commission was working to revet the most dangerous areas.[75]

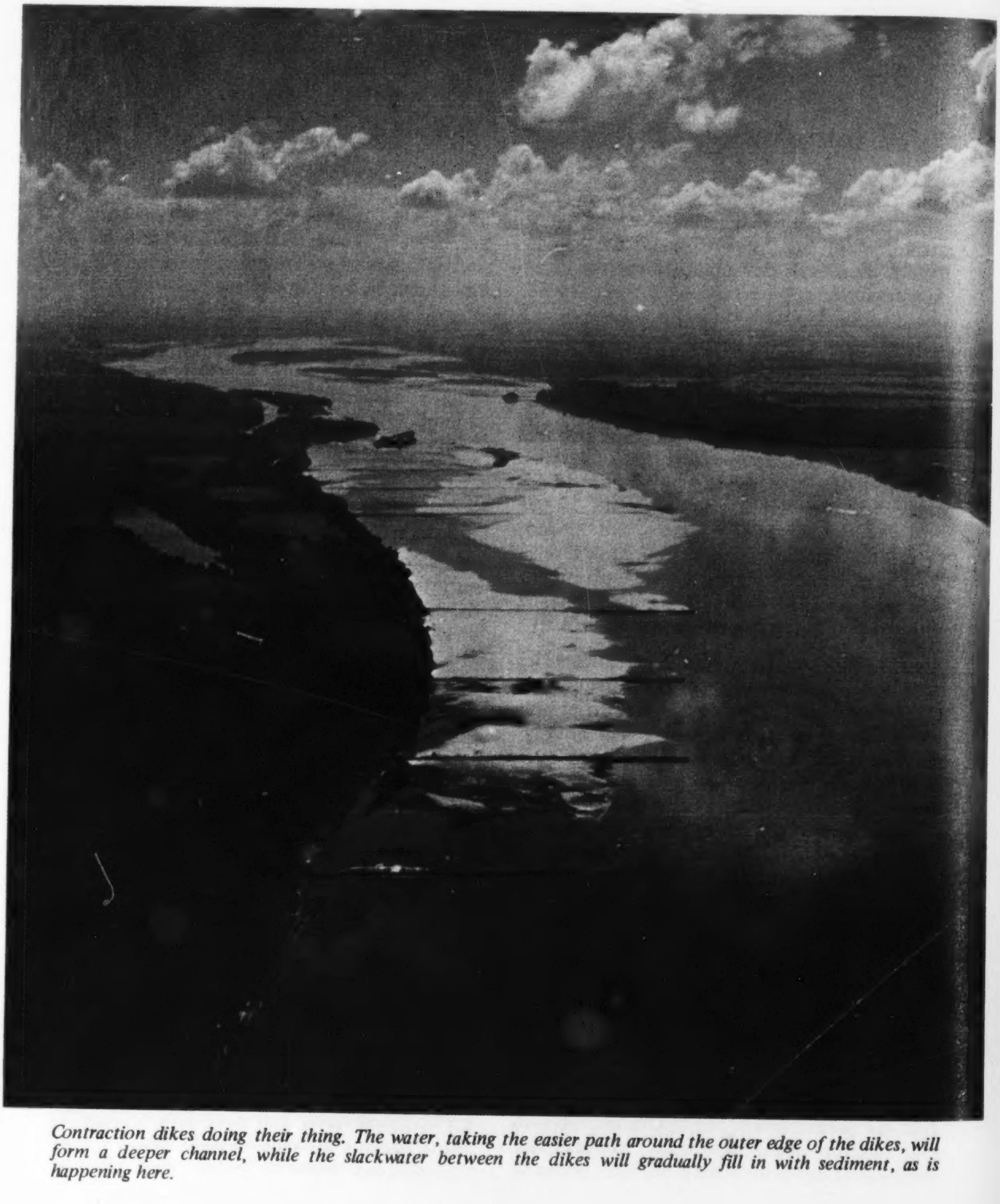
The search for better bank revetting material was equally unrelenting. For several years, the Memphis district had revetted part of the banks with lapped slab concrete. By 1931, continued experiments developed a new type of slab. These slabs, 10 by 6 feet by 4 inches, were designed to be interconnecting, but with the elimination of the lapper portion. The mats were placed end to end, therefore, less material was required to revet a section of bank. None of this type revetment was used in 1931 because the plant was not finished before the work season ended.

In 1931, the Memphis Engineer District was using five types of revetment. In addition to the type just described, the district was using willow revetment, concrete revetment, permeable dikes, and rock groins. Dikes were most often used as contraction works, but several times they were used as bank protection. During 1931, more than 49,000 linear feet of revetment of all types was placed on the banks. More than 9.5 miles of permeable dikes were in place at the end of the fiscal year.[76]

Traffic on the river, year by year, was increasing. The packet boats were nearing the end of a long and illustrious career, but towboats and their barge tows, carried several times the amount of packet cargo. In December, 1931, the towboat *St. Louis* arrived at New Orleans with a cargo of cotton that many believe was the largest amount ever carried on the Mississippi. Twenty-five thousand bales was placed on five barges at Memphis, and, at Vicksburg, three barges carrying thirty-two hundred bales were added to the tow. Along with the 28,200 bales of cotton, the tow carried three other barges filled with grain and merchandise.[77]

Providing an adequate navigation channel for tows like the *St. Louis* was an intricate part of work on the Mississippi. Approximately fifty percent of all money spent in the Memphis district was expended for improvement of navigation. The massive tows that were then coming into common usage made it incumbent that the Engineers keep the channel clear. In 1931, the Memphis district undertook experimental dredging to determine the feasibility of training channels by early dredging, before the low water stage. It was thought that such early dredging might alleviate the difficulties encountered when dredging operations awaited the fall of the river to determine the trouble spots. These experiments were successful and the program of preventive dredging was adopted.[78]

One unexpected hazard to navigation developed in 1931. Norris Kellum, known as the "Human Cork" and a nationally known swimmer, jumped into the Mississippi at Cairo. Ninety-six hours and 227 miles later, he left the river at Memphis at the foot of Beale Avenue. This was both a record for long distance swimming and also an endurance record. An exhausted and blue (color) Kellum received the accolades of a crowd of supporters at Memphis. Kellum said that all along the river vast crowds came to the river banks to wish him well. There was one exception when a man appeared on the bank leveled a gun at him warning that if any prohibition agent came near his place he would shoot – it made no difference if he was disguised as a swimmer.[79]



Contraction dikes doing their thing. The water, taking the easier path around the outer edge of the dikes, will form a deeper channel, while the slackwater between the dikes will gradually fill in with sediment, as is happening here.

CHAPTER VI

Dredging, Elevating, and Cut-offs

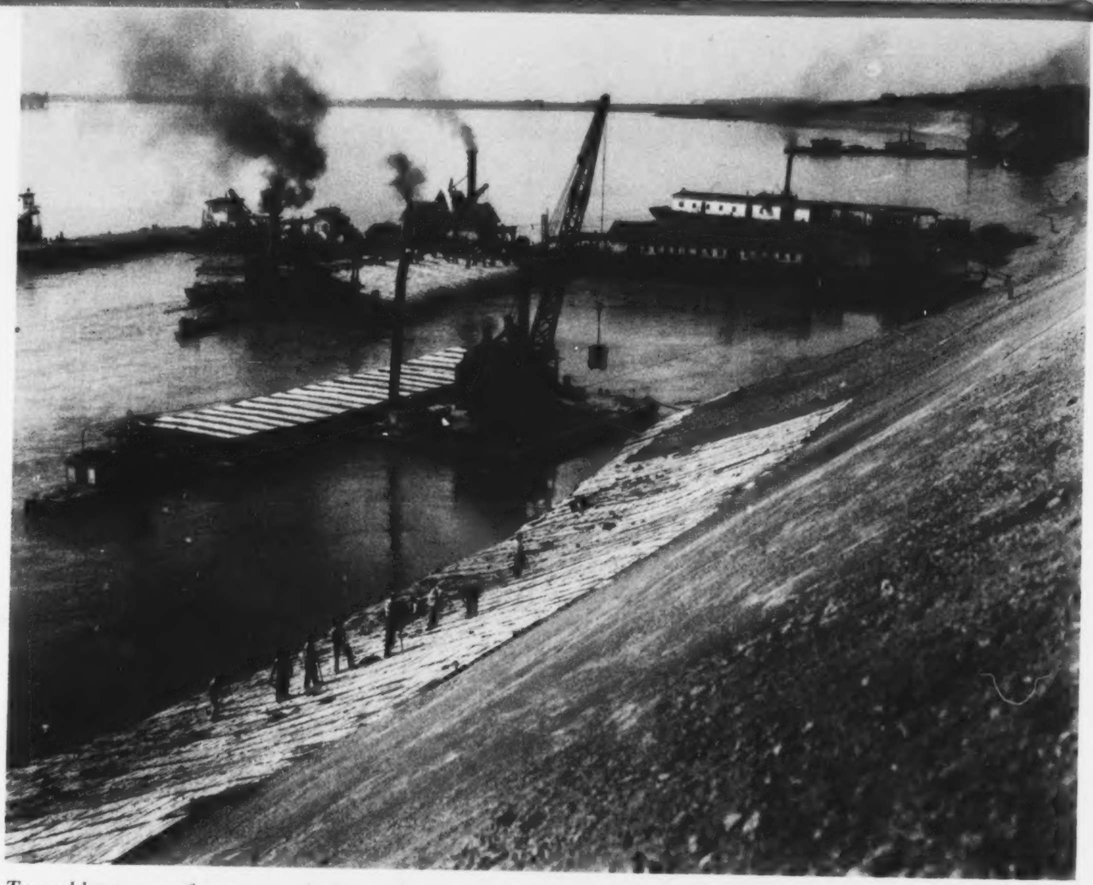
During 1932, flood control work in the Lower Mississippi Valley was delayed for two reasons. First, there was a concerted attempt by the Hoover Administration and the opponents of the existing program to remove flood control work from the Engineers and the Mississippi River Commission. In defending themselves, the Engineers and the River Commission used valuable time that could have been productive in flood control work. Second, the Corps was again fighting against amending the Jadwin plan. The House was considering the Wilson bill, which would have authorized flowage payment for land utilized by Engineers in levee setbacks along the river. A determined fight finally resulted in the defeat of the Wilson bill. However, the two battles in Congress resulted in a delay of appropriations for flood control work beyond the end of the fiscal year.[1]

All types of flood control work in the Memphis District were delayed because of high water, bad weather, and by the vascillation of Congress in making appropriations. Once allotments were in hand, the Engineers pushed the work with vigor. More than 14.6 million cubic yards of material were added to the levees. Bids were invited for 12,000 linear feet of concrete flood wall for the protection of Cairo, Helena, and Caruthersville and work on the setback levee of the Birds Point - New Madrid Floodway was 98 percent complete.[2] Suits had been filed for the acquirement of flowage easements on about half of the land tracts in the floodway. Of these, sixty-one had been settled at prices satisfactory to the Engineers. In addition, the District Engineer had conducted a survey and recommended flood protection for the Mounds-Mound City, Illinois area.

The new preventive dredging program made the addition of more dredging plant imperative. In July, 1932, the District Engineer accepted delivery on two new dredges acclaimed as the most powerful river dredges ever built. Christened the *Ockerson* and the *Potter*, the dredges were built at a cost of $485,000 each. The dredges were immediately put into service along with six other dredges and operated on forty-two crossings during the low water season.

Development of an improved concrete revetment was an ongoing project. The Engineers intended to eliminate willow mats from their revetment program. Not only was concrete more durable, the initial cost of concrete revetment was twenty percent below that of willow mats. Willow brush was also in short supply because of many years of use as revetment materials. However, rumors that willows would be abandoned brought strong opposition from lumber interests and planters who owned large tracts of land containing willows. The District Engineer tried to ameliorate the criticism by allowing bids from private contractors on revetment work. Little interest was shown in the actual revetment work by private contractors because of the expensive equipment required to do the work. All the contractors wanted to do was to sell the materials needed.

The Memphis Engineer District had planned to discontinue the use of willows in 1931, but, the private contractors who sold willows to the Engineers acquired a powerful ally in the person of Senator Kenneth McKellar of Tennessee. McKellar asked the Secretary of War to intercede. Whether McKellar's influence was paramount or not, the District Engineer called for bids on 38,000 cords of brush and poles.[3]



Two older types of revetment-laying techniques are depicted here. At the center of the picture we see the crane picking up individual squares of articulated mat and placing it on the upper bank, where it would be jockeyed into position and tied. In the background we see the mattresses being assembled and tied on a mat laying plant, which then slides out from under the completed mattress as it falls into place on the subaqueous slope.

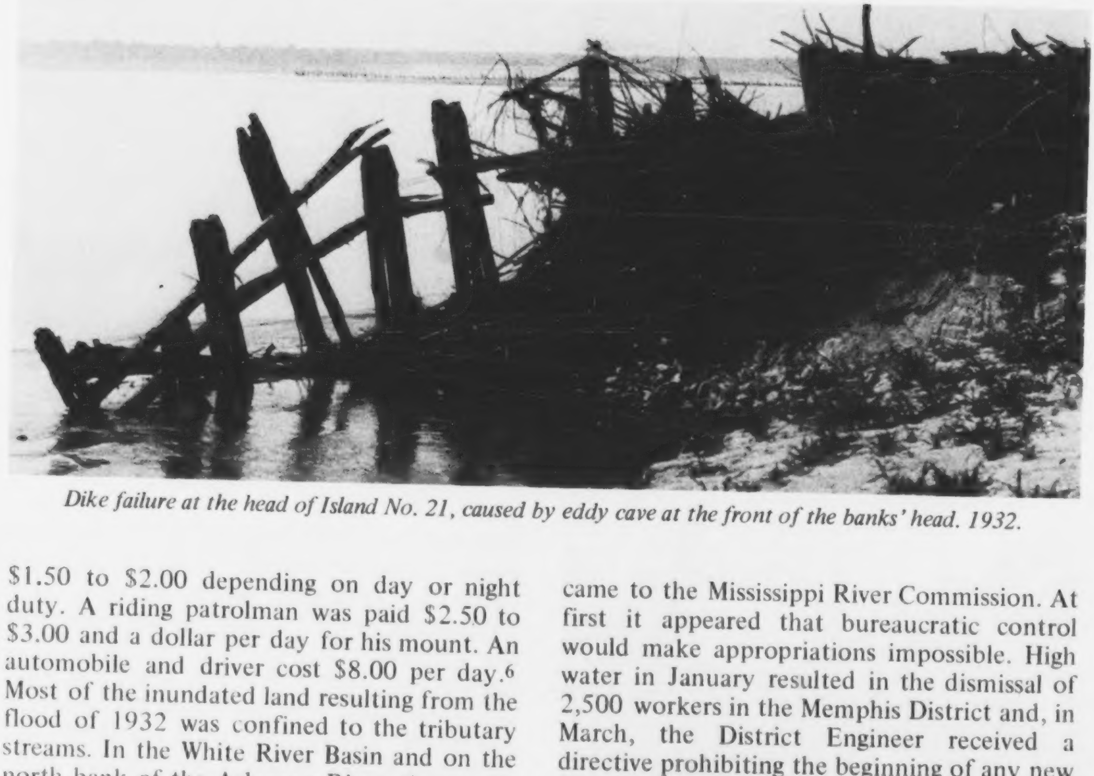
While the debate over willow revetment heated up, the District Engineer continued experiments with butt-end concrete revetment. The results of these experiments and investigations indicated the desirability of abandoning the slab concrete in favor of the articulated concrete revetment that had been developed in the Vicksburg District. Today, this articulated concrete mattress, with minor modifications, has been the ultimate answer to revetment problems. It was developed to answer the problem of inflexibility as characterized by the slab revetment. Maximum advantage is gained by the revetment unit only when it conforms to the contour of the bank, as any scour that develops back of the revetment, either through bank wash or eddy current, will cause the revetment to weaken, break, and ultimately wash away. The concrete slab was particularly vulnerable to this type of destruction. In the articulated concrete mattress concept, the revetment material consists of sections of concrete blocks, held together by corrosion resisting wire. When laid on a surface, the articulated mat not only conforms to that surface, but it can also adjust to that surface as the surface changes. As presently standardized, the mattress is constructed as a 4x25 ft. unit. Each unit consists of 20 blocks of concrete, with each block having dimensions of approximately 1 ft. 2 inches by 3 ft. 10 inches, by 3 inches thick with spaces of 5/8 inch between the blocks, and an opening of 1¾ inch between the units. The installed articulated mattress unit is designed to cover an area of 4 ft. 25 ft. The units are of course bound together by the same corrosive resistant wire that ties the individual blocks together. The units are transported to the site on the barges, where they are wired together and rolled out on the bank by an efficient and complex mattress sinking plant.[4] In fiscal 1932, the articulated mattress unit of the Vicksburg District was transferred to Memphis and operated in conjunction with the concrete slab unit in execution of the season's program of bank protection work.

That fiscal year the Memphis District placed more than 84,000 feet of revetment on the banks of the river and only about 15,000 feet of willow revetment was used. Contraction work consisted of the construction of 12.9 miles of permeable pile dikes. Concrete revetment placed on the banks in the Memphis District during 1932 consisted of more than enough concrete to have built a four-foot wide sidewalk from Memphis to New Orleans.[5] As a result of the experiments with the articulated concrete mattress, the Mississippi River Commission in 1932 directed that all other forms of revetment be discarded and the new improved articulated concrete mattress be used exclusively.

A too familiar scene following the high-water season. The pile dike has managed to hold despite the debris and pressure which accumulated against it, but extensive repairs will be necessary before the next season. Island No. 8, 1932.

In 1932, the Mississippi River gave every indication that there would be extensive flooding. For the first time in the history of flood control in the Mississippi Valley, the Engineers devised a program of preparedness in co-operation with levee districts in the Memphis area. The Flood Control Act of 1928 had not provided for government assistance until a flood emergency had gone beyond the control of levee boards. Major Brehon Somervell, Memphis District Engineer, pushed precedent aside in anticipation of a major high-water fight. More than forty levee veterans met in Memphis. A plan calling for close centralization and experienced levee patrols for every foot of levee in each individual sector was indorsed by those in attendance. Major Somervell believed the action necessary because most of the levee districts had defaulted on their bonds and did not have enough funds to meet an emergency. Levee districts could no longer borrow money and it was the first real indication that the depression had hit the levee boards.

Flood fighting in 1932, though cheap by today's standard, was an expensive operation for levee districts hit by the depression. A common laborer was paid $1.50 per day. Walking patrolmen on the levees were paid



Dike failure at the head of Island No. 21, caused by eddy cave at the front of the banks' head. 1932.

$1.50 to $2.00 depending on day or night duty. A riding patrolman was paid $2.50 to $3.00 and a dollar per day for his mount. An automobile and driver cost $8.00 per day.[6] Most of the inundated land resulting from the flood of 1932 was confined to the tributary streams. In the White River Basin and on the north bank of the Arkansas River, there were more than 535,000 acres flooded and the damage sustained was more than $95,000.[7] Even though the anticipated high stages in the Mississippi River had not materialized, the District Engineer had established the precedent of a centralized flood fighting apparatus.

In 1933, the New Deal of Franklin Roosevelt and its salient features, including large appropriations and bureaucratic control, came to the Mississippi River Commission. At first it appeared that bureaucratic control would make appropriations impossible. High water in January resulted in the dismissal of 2,500 workers in the Memphis District and, in March, the District Engineer received a directive prohibiting the beginning of any new flood control work or construction. No reason was given for the directive, but speculation had it that the stop order was to be in force until an unemployment relief plan could be adopted by Congress.

Even though the Engineer District and private contractors had agreed to implement the labor policies of the National Recovery Act, no allotments were made. On July 22, 1923, the District Engineer ordered that all

Dike failure and cause at Keyes Point, Tennessee, 1933.

hired labor except dredging, dredging surveys, gauge repairs and readings, and a limited amount of work at the Repair Shop, be discontinued on July 24th. At the same time it was ordered that the payroll of the district be reduced by fifteen percent on August 1st.[8] More than 450 employees were dismissed on July 24th and several more were separated at the end of July.

The logjam on appropriations was broken in mid-August, but the stream of money was only a trickle and, work on the flood control project had now been delayed several months. By September the floodgates holding back appropriations were opened and the money began to flow in torrents, and the middle of October more than 9,000 workers were employed on the flood control project. The Chief of Engineers ordered all districts to do as much as possible to relieve the unemployment crisis. With this view in mind, he ordered that all levees be constructed by manual labor instead of by machines unless the cost of manual labor exceeded by ten percent the cost of doing the work by machines.[9] All records for flood control expenditures in the Memphis district were broken during November, with expenditures totaling more than $3 million.

Major Somervell revealed that approximately 273 miles of the contemplated 580 miles of levees in the district had been completed. During the preceeding four years nearly $50 million had been expended on the project.[10] In 1933, more than 29.3 million cubic yards of material was added to the levees in the district. The Birds Point - New Madrid Floodway was completed and progress was being made on obtaining flowage rights.

Revetment of the river banks was being carried on twenty-four hours a day in six-hour shifts. A thirty-hour week had been instituted to give more people employment. Even though revetment work had been delayed several months, almost 30,000 feet of concrete revetment was placed on the river banks. In addition, more than 55,000 feet of dikes

A grading bucket taking the slope down to proper incline for bank paving. Reelfoot Front, 1932.

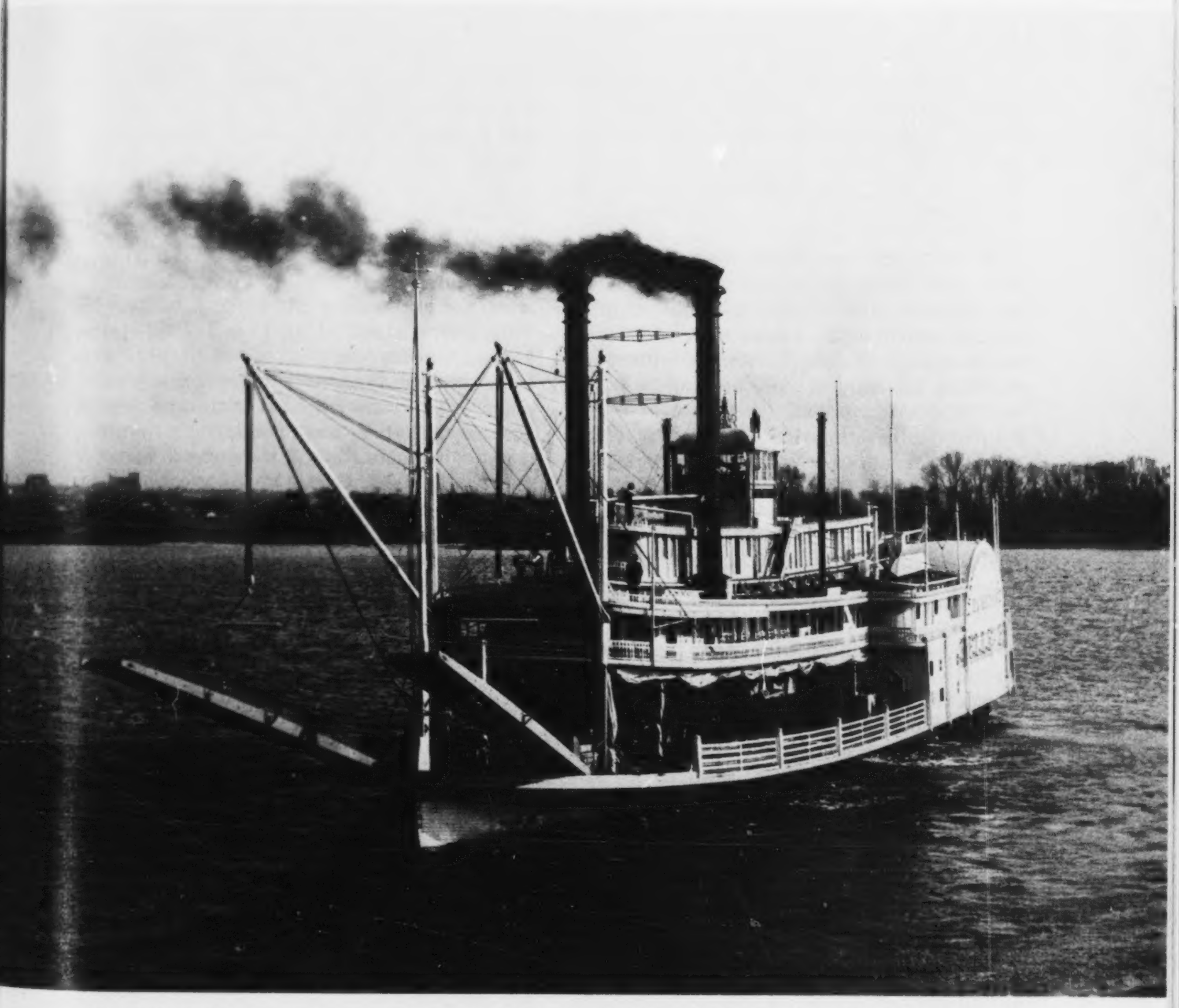
were constructed. At the end of the fiscal year there were 150 miles of revetment on the banks of the Mississippi under the jurisdiction of the River Commission. Since the revetment program's beginning in 1881, more than $109 million had been expended on bank protection.[11]

The problems of keeping a nine foot channel open for navigation are tremendous. A dredge cut can be obliterated in a matter of days. Near Island No. 35, a dredge cut was made by removing some 660,000 cubic yards of material to obtain a channel 300 feet wide and 20 feet deep. A subsequent rise of twelve feet in the river followed by a sharp fall refilled the area with 461,000 cubic yards in the cut itself. In the 1.18 square miles immediately adjacent to the cut, the river deposited an additional fill of 2,186,831 cubic yards. It was necessary to redredge one area in the vicinity ten times.[12] During the dredging season, eight dredges operated on 37 crossings from Belmont Point to the mouth of White River.

On March 12, 1933, the Dredge *B. M. Harrod,* largest dredge boat attached to the Engineers' fleet at Memphis, sank in eighteen feet of water while tied to a floating dock at the fleet headquarters at West Memphis. A crew of 45 was working on the dredge when it sank, but all managed to leave safely.[13] The dredge fleet was further reduced when the Dredge *Iota* was condemned. In 1933, the River Commission authorized the construction of two new dredges. One was named the *Jadwin* and the other was named the *Burgess* after Colonel Harry Burgess who had been identified with the work of several of the district offices in the Mississippi Valley. Acquisition of the *Jadwin* and the *Burgess* ended construction of dredges by the River Commission.[14]

Relatively high stages on the Mississippi were experienced in 1933, and new record crests stages were set on the St. Francis River. Pitched battles were fought in Mississippi between National Guardsmen and citizens attempting to dynamite the levees. Levees were dynamited at several places and, on the Yazoo River levee, between 200 and 300 shots were exchanged between men in boats trying to cut the levees and patrols on the levees.[15] A record crest stage of 27.1 was set on the St. Francis River at St. Francis, Arkansas, on May 19, 1933. During the two floods on the St. Francis, in January and in May, there were twenty-nine breaks in the local levees north of the Missouri-Arkansas state line. The Memphis Engineer District gave assistance in the form of sandbags and engineering advice. All of the levee breaks but one were closed while water was flowing through, thus reducing the amount of land overflowed. But, before the breaks could be closed, 117,100 acres were inundated.[16]

In 1933, a new Era was initiated with five artificial cut-offs being made in the bends of the Mississippi River below Memphis. The adoption of a cut-off program by the River Commission meant the reversal of a policy it had advocated since 1884, and the decision had not been reached lightly. Nor was the concept of artificial cut-offs a new concept in river engineering. In 1831, Captain Henry Shreve, the father of the Mississippi River steamboat, made the first artificial cut-off at the mouth of the Red River. In 1848, the stage of Louisiana made a second artificial cut-off at Raccourci Bend, several miles below Shreve Cut-off.[17] The immediate post-Civil War era had witnessed an explosion of imaginative schemes involving shortening of water routes through cut-offs. One of the



One of the prettiest as well as one of the fastest Packets on the lower Mississippi, the "Belle of the Bends" was skippered by the venerable and colorful Captain Milt Harry. Utilizing the speed of the "Belle," Captain Harry delighted in embarrassing his competition, and he harrassed them in court as well. The "Belle" was lost to Captain Harry in an alleged conspiracy which resulted in the beaching of the ship during the busy season, and creditors claimed it. The charming "Belle of the Bends" now rests in a watery graveyard at Cairo.

most breath-taking of these schemes was that which envisioned a network of canals and natural water-ways that would create a water route from Tuscumbia, Alabama, on the Tennessee River, to Brunswick, Georgia, on the Atlantic coast. Such a canal would have made it possible to bypass Florida, the entire Gulf Coast, and the whole lower Mississippi Valley. President Grant rejected the scheme, and ignored a Memphian counter-proposal for a canal which would connect the Mississippi at Memphis to the Tennessee River at Pittsburg Landing, site of the famous Battle of Shiloh. That scheme was more practical, and would have shortened the water route from the Tennessee Valley to Memphis by some 500 miles. The editor of the *Memphis Appeal* was furious that "his Imperial Highness, Ulysses the First, Emperor of the American States of the North," was so simple minded as to ignore such a "palpable and obvious" plan.[18]

The end of Radical Reconstruction signaled a return to conservative ideas and economic retrenchment, so the exhilarating concepts in river engineering were put in abeyance. By the time of the creation of the Mississippi River Commission the concept of artificial cut-offs was in general disrepute, primarily due to the fact that in the 1870's and 1880's the Mississippi River had created several cut-offs on its own initiative. Those natural cut-offs had produced drastic changes in the regimen of the river; great areas of land which had been on one side of the river were now on the opposite side, and state boundaries were proportionately confused. Also the cut-offs had produced new navigation problems, greater river velocity, property evaluation changes, troublesome port conditions, and general unhappiness. The older, artificial cut-offs and the newer natural cut-offs were acknowledged failures as far as flood control and navigation were concerned, for whereas a cut-off would lower the water level in one area it would increase the velocity of the river and raise the water level further downstream. The relative merits of cut-offs were to be debated for the next forty-six years. From 1884 until the 1930's the Commission used all of its engineering and forensic powers to oppose any natural or artificial cut-offs on the Mississippi, but the great Flood of 1927 had again opened the doors of imaginative river engineering, especially as concerning flood control, and there was little arguing that one way to evacuate flood waters was to shorten the route to the Gulf. Out of the Flood of 1927, then, came the renaissance of the cut-off concept. A "levees only" policy had already been abandoned by the River Commission.

In 1929, events occurred which led to a rejection of the policy of "no cut-offs at any price." At Hard Times Bend, about forty miles below Vicksburg, the river had been eating away at the bend's narrow neck. Though the River Commission had used every means of its disposal to prevent it, a natural cut-off into the Black River occurred in September, 1929. The engineers tried desperately to close the cut-off with willow mats, but the discharge through the channel was so great that the effort was finally abandoned. Known as the Yucatan Cut-off, it now indicated that a slow developing cut-off would not produce such radical changes.

General Thomas H. Jackson, President of the Commission, ordered a model of the Greenville Bends be built and tested by the Experiment Station in 1930.[19] Though still not entirely convinced that cut-offs' were beneficial, General Jackson began plans for an artificial cut-off across Diamond Point, and directed that new tests be made in the spring of 1932. In June 1932, General Jackson was replaced as President of the River Commission by General Harley B. Ferguson, who would become the most fervent advocate of the cut-off program.

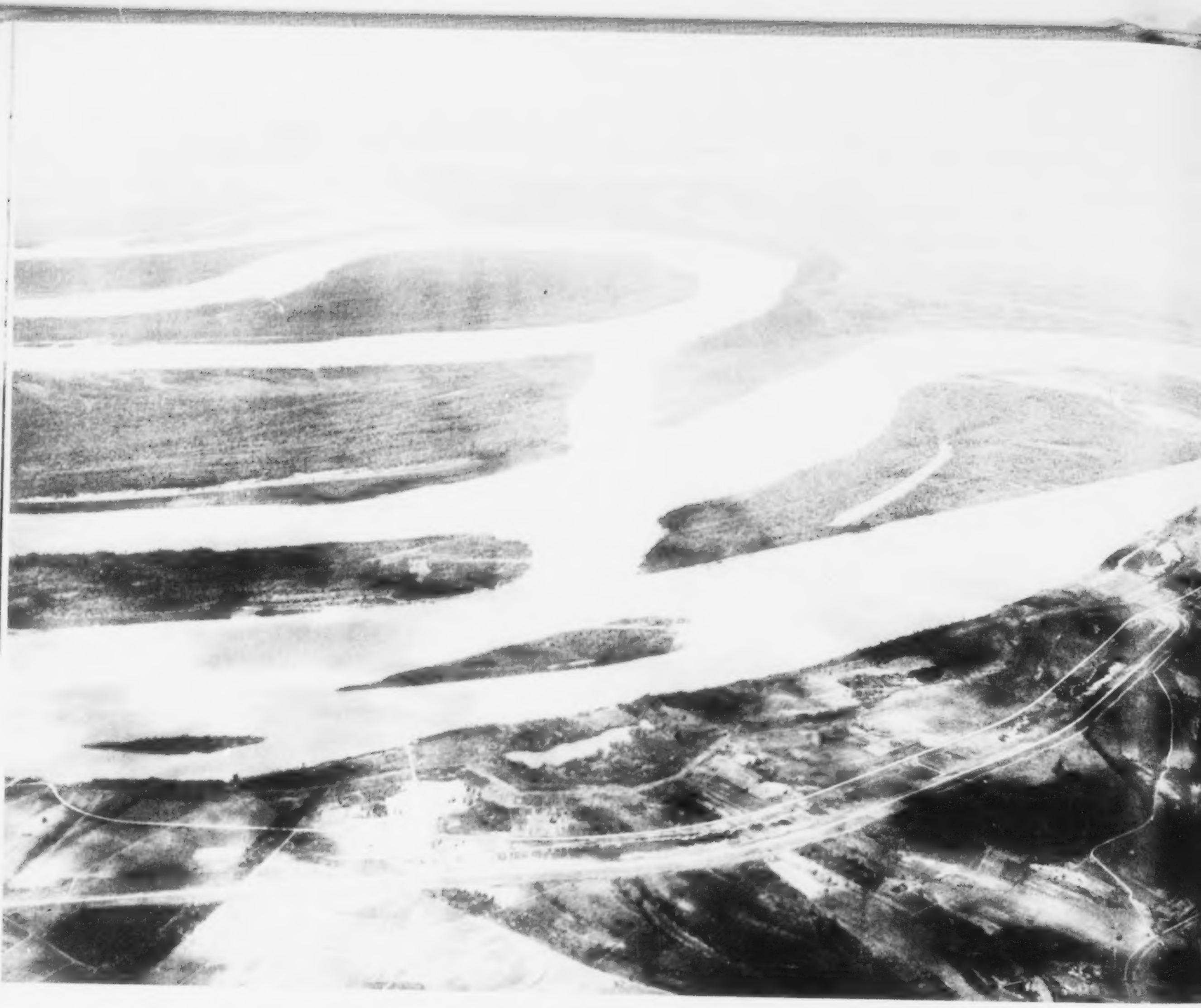
General Lytle Brown, Chief of Engineers, reported that – up to 1933 – some authorities on the river had a hostile attitude toward any alteration of the Jadwin plan and it was remembered that Jadwin had rejected cut-offs as a flood control device. General Ferguson had not been associated with the Jadwin plan and it was hoped he would be able to develop new methods of flood control. Ferguson was appointed President in the "...hope that he would not be crippled by adherence to any hard and fast ideas."[20]

The policy of preventing cut-offs had found justification in that the River Commission lacked both the funds and equipment to undertake a sustained program of cut-offs. Since 1930, General Ferguson had been reviewing in his mind what appeared to be a feasible plan for cut-offs. River engineers in Europe had been making cut-offs for several years by cutting a channel across the neck of a bend to its full dimensions before allowing the water to enter it. General Ferguson rejected this method in favor of a pilot-cut across the neck, a technique made possible by the development of the hydraulic dredge. Dredging a small pilot-cut across the neck of a bend would allow the gradual development of a cut off, preventing high velocities and raising flood stages in the river downstream from the cut-off. If the pilot cut-off was not enough to cause cut-off development, later dredging could be done to make the pilot-cut larger. The Yucatan Cut-off had developed in this manner and it proved that a narrow channel a mile or two in length was superior to a short cut across a narrow neck of land.

General Ferguson pushed the program of cut-offs where General Jackson had been reluctant to start it. Actual field work at Diamond Point had been initiated by General Jackson, but General Ferguson gave added impetus to the work and, in a final break through, the pilot-cut was completed on January 8, 1933. By April, 1936, the discharge through the cut-off was 754,000 cubic feet per second, or 57 percent of the total discharge.[21] Thus, the River Commission had broken new ground and had relieved itself of one more shackle that had confined its thinking on flood control for forty-eight years.

During 1933, four other cut-offs were made below Memphis. Glasscock Cut-off (Mile 723), with a dredged cut 20,800 feet in length, was first opened on March 26, 1933. This cut-off did not prove as successful as the one at Diamond Point. Providing a channel only at high water stages, the Glasscock Cut-off was further enlarged in the succeeding years. By the beginning of 1936, there was still no low water channel because of bank caving in of the pilot-cut. In April, 1936, the discharge through the cut-off was 170,000 cubic feet per second, or 13 percent of the total river discharge.[22]

Though Glasscock Cut-off had proved troublesome, the cut-off program continued unabated. On May 25, 1933, Giles Cut-off (Mile 690) was opened to high water flow and, on October 6, 1934, was opened to



traffic at all stages of the river. By April, 1936, the discharge through the cut-off was 415,000 cubic feet per second or 31 percent of the total river discharge.[23] A fourth cut-off was opened at Leland Neck (Mile 472-483) on July 8, 1933, by levee machines and blasting. During the peak of the high-water in April, 1936, more than a million cubic feet of water per second was flowing through the cut. This was 83 percent of the total discharge of the river.[24] The fifth cut-off of 1933 was opened at Worthington Point (Mile 505-513) on December 25. This cut-off cost more than $303,000 for the construction of the pilot-cut, which was 3.8 miles long. By June, 1936, 62,800 cubic feet per second, or 20 percent of the total river discharge, was passing through the cut.[25]

In subsequent years additional cut-offs were made at Hardin (Mile 676), Jackson (Mile 624.4), Sunflower (Mile 621.(, Caulk (Mile 568.5), Ashbrook (Mile 542), Tarpley (Mile 535), Sarah (Mile 498.2), Willow (Mile 457.7), Marshall (Mile 443.9), and Rodney (Mile 385.4). The aggregated distance by pilot-cuts came to more than 47 miles. Combined distance around all the bends cut-off was almost 200 miles. Net shortening of the river amounted to 151.8 miles.[26]

The Sunflower cut-off was one of those rare moments in history when a man, working alone with a shovel, had the grand opportunity to change the course of the Mississippi River. The engineers had made the pilot cut across the neck of land, but had not removed

An aerial view of the Leland Neck, Tarpley, and Ashbrook Cut-offs, showing how drastically and dramatically the River can be shortened through the use of cut-offs.

the "plug," *i.e.* the last remaining piece of land blocking the initial flow of water through the pilot cut. One nearby landowner waited with growing impatience, however, for he anticipated that the new channel would relieve erosion of his property as it was located on the bend of the river. The engineers had determined to wait until an optimum time to remove the plug, but one early morning inspection disclosed that the farmer had been working by lantern light at night and had nearly completed a small trench that would take out the pilot plug. In order to have some control over the situation, the engineers decided to remove the plug before the individual did it without supervision.[27]

Harding Cut-off was opened on March 18, 1942, and ended the program of cut-offs on the Mississippi River. Though Hardin Cut-off was the last cut-off to be constructed, others were advocated as late as 1962.

The bend at New Madrid had long been recognized by the River Commission as a place where the next cut-off would be undertaken. Twenty years after the last cut-off had been opened, in 1962, the Commission passed a resolution directing that the Memphis Engineer District make a detailed study of Slough Landing Neck (Bessie) with a view to the construction of a cut-off at this point. After a careful study, the District Engineer recommended that no cut-off be constructed. He based his conclusion on the opposition of both the local citizens and the navigation interests were aroused to the benefits that would result from a cut-off.[28]

In 1934, the Blue Eagle, the emblem of the National Recovery Act, came to flood control work on the Mississippi River. The River Commission received more than $42 million from this source during fiscal 1934. More than $12 million was allotted to the Memphis Engineer District to prosecute flood control and navigation works. Eighty-five Memphis firms gave certificates of NIRA compliance in order to participate in the work. Snag-boats, steamboats, dredges, and motor boats in the Memphis district piled up a total of 110,000 miles while carrying on the work.[29] Work in the Memphis district had progressed to a point where no suggestions or complaints were heard when the River Commission passed through Memphis.

The people of the Valley might have been complacent about the Mississippi, but the Memphis Engineer District was not ready to say that the river was under control. Major W. M. Hoge, District Engineer, believed that the Mississippi River and man were in a continuous state of war. Wind plus the drainage from thirty-one states would easily combine in a formidable attack. Levees were the frontline defense of the Engineers, supplemented by floodways and spillways. But the river could increase its strength from an inconsequential 86,000 feet per second in low water to a fantastic 2,250,000 CFS in high water. In a matter of a few days the river could go from zero on the gage to fifty-five feet, and expand its width from 1,500 feet to six miles. Every year between December and June, the war between man and the river was carried on. Major Hoge reported that "we have learned that flood control is a military problem, requiring organization, intelligence, supply and training of a huge force to fight."[30]

The Mississippi was relatively tranquil through 1934. Nevertheless, the Engineers refused to breathe easy until the last of the high water had passed out of the district. The odds were that one of the districts under the control of the River Commission would be flooded each year. Weather Bureau reports pointed out that a flood of major proportion occurred in the Memphis District every 5.2 years. The average for Cairo, which was a part of the Memphis district, was only 2.08 years.[31]

A formal posing of the District Engineer, Major William M. Hoge (1933-35), and his staff. Back Row, left to right: David N. Brock, Herbert T. Knapp, Victor M. Cone, Harrison V. Pittman, Clarence E. Boesch, Garner W. Miller, Philip R. Van Frank, William M. Parkin, and Luther Y. Kerr. Seated, left to right: Captain Harley Latson, Captain James B. Newman, Jr., Captain Hans Kramer, Major Hoge, Captain Bernard L. Robinson, 1st Lt. Thos. A. Lane, and the ever-present Mrs. Aline Tanner (Secretary).

Low river stages presented the most serious problems for the Memphis district during 1934. At Memphis, the river was below the ten foot stage for 260 days during 1934. In September, the stage dropped to 1.4 feet, the lowest stage in several years.[32] Such low stages usually required extensive dredging. The true amount of dredging required in 1934 is not reflected in reports of the District Engineer because the information conforms to the fiscal year; thus only the dredging completed by June 30, 1934, was reported.

During 1934, the two newest dredges, *Jadwin* and *Burgess*, were turned over to the dredging fleet. Each of the dredges could dig a cut ten feet deep and thirty-two feet wide through a sand bar at the rate of 600 feet per hour. With sufficient boiler power to operate propelling and pumping machinery at the same time, the two dredges could extend their "ladders" and dig to a depth of forty feet. The *Jadwin* and *Burgess* were delivered at an opportune time.

Nine dredges were operated in the Memphis district on sixty-seven crossings during fiscal 1934 from Muscovalley (Mile 25) to the mouth of the White River (Mile 392). In addition, dredging was carried on at several other locations for corrective dredging and channel stabilization. One interesting aspect of the 1934 program was the dredging of a trench, from which 109,520 cubic yards of material was removed. The Dredge *B. M. Harrod*, which had sunk the year before while under repair at the shop, was pushed into the excavation to prevent it from interfering with navigation. All types of dredging during fiscal 1934 required the removal of more than 31.5 million cubic yards of material in the Memphis district. Costs of the dredging operation ran into more than $1.5 million.[33]

Though not a part of the Memphis district, dredging to produce cut-offs was carried on at seven locations. Several of the cut-offs opened in 1933 required additional dredging and two new cut-offs were opened. Marshall Point Cut-off (Mile 587-593) was opened on March 12, 1934. The length of the pilot-cut was 3.1 miles. By June, 1936, 157,000 cubic feet per second, or 73 percent of the total discharge was passing through the cut. On April 8, 1934, Willow Point Cut-off (Mile 564-578) was opened after a pilot-cut of 4.7 miles had been completed. Seventy-one percent of the total discharge of the river was flowing through the cut by June, 1936.[34] Total River Commission expenditures for dredging in fiscal 1934 came to more than $4.9 million.

The first extensive New Deal appropriations became available in fiscal 1934 and, as a result, bank protection work was expanded. During that year, the Memphis district saw the placement of 16,520 linear feet of new revetment, and 739 feet of pile dikes designed to protect an additional 1,700 linear feet of bank. Repairs to old revetment consisted of more than 7.4 million square feet of mattress and 1,226 linear feet of pile dikes.[35]

In 1934, the Memphis Engineer District undertook experiments with a tetrahedral block type of bank protection. Tetrahedral type revetment had been developed in the Vicksburg district. This revetment consisted of covering the river bank with a blanket of concrete blocks each with an height of about one foot and shaped in the form of tetrahedrons. The blocks were placed by hand above the water line. Below the water surface the blocks were thrown from barges and distributed over the area to form a blanket. About 215 linear feet of bank was protected

One of the experimental concepts in upper bank paving, utilizing tetrahedral blocks, hand-placed in geometric pattern, 1933.

by this method during 1934 without any determination of its effectiveness.[36]

Ever since the Flood Control Act of 1928, the Memphis district had been building contraction works at a rapid raté. By June, 1934, over thirty-four miles of dikes had been constructed. Basically, the effectiveness of a dike depends upon its ability to make deposits where flow is not wanted, and its ability to give direction to low water flow in crossings. Dikes constructed by the Memphis district showed an average fill of 4.5 feet per year. One example was the series of dikes constructed opposite Caruthersville, Missouri. These dikes were designed to close the Tennessee Channel, thus eliminating a treacherous crossing, and to deepen a secondary channel along the Caruthersville front. When completed, the dikes resulted in the closing of the unwanted channel and the development of a wider and deeper channel along the Caruthersville front.[37]

National Recovery Administration and Public Works Administration funds helped to increase the amount of levee construction carried out in the Memphis district. The Lower St. Francis Levee District was able to insure both protection for northeast Arkansas and solvency for itself when it was authorized to sell $500,000 in bonds to PWA. Funds provided by the NRA resulted in the construction of several thousand feet of contraction and bank protection works. More than 25.4 million cubic yards of material was added to the levees in the Memphis district with NRA funds. Altogether, more than 48.4 million cubic yards of dirt was added to the levees in the area controlled by the Memphis district. At the end of fiscal year 1934 the River Commission had 2,129.2 miles of projected levees, of which 77.7 percent were completed to grade and section. Since 1882, the Commission had expended more than $407 million on levees.[38]

Flood control work in the Memphis Engineer District was reduced considerably in 1935 because work on the levees and other flood control features were nearing completion. Major W. M. Hoge, District Engineer, reported that the progress on the program would make a river stage like that of 1929 (41.5 feet) harmless. An additional 162 miles of levees had been constructed since 1928. Of the 595 miles of main stem levees, 544 miles were complete. The flood control program in the Memphis district had reached such a stage that local forces would not be called on to mobilize until the Mississippi River reached a stage of 47 feet at Cairo.[39]

Though the flood control program in the Mississippi Valley was nearing completion, continuing efforts were still to amend the Jadwin plan. For six years several members of Congress had been trying to get compensation for lands affected by setback levees. They were nearly successful in 1935 when the Wilson bill made its way through the legislative mill. However, objection by the War Department resulted in a veto of the bill by President Roosevelt.[40] Defeat did not assuage the move to bring about changes in the flood control program for the Mississippi Valley.

General E. M. Markham, Chief of Engineers, was not tied to the Jadwin plan and, in late 1934, he ordered the River Commission to review the project provided by the Flood Control Act of 1928. The report was sub-

mitted on January 19, 1935, and received the approval of the Chief of Engineers. A completed revision of the flood control plans for the area between the Arkansas and Red Rivers was recommended. The new plans were designed to reduce the area submerged in an extreme flood and included plans for protection for the Atchafalaya Basin. The project, if approved, provided for the acquisition of flowage rights in floodways at reasonable costs based on 1934 assessed value of the lands; for flood control protection for the St. Francis and Yazoo Basins to protect them from tributary floods was recommended; and, finally, for the construction of roads on levees to facilitate maintenance and better accessibility during a flood emergency. Estimated cost of the new features and completion of the existing project was placed at $313 million, to be expended over a period of six years.[41] Elements of this plan would be incorporated in the Bills of 1936.

The floods of 1935 on the tributary streams of the Mississippi pointed up the need for flood protection in these areas. Rain over the tributary streams resulted in a prediction by the Memphis district that a major flood on the Mississippi was probable in the spring. Though the river was out of its banks for nearly two months, the main stem stages were not excessive. On the tributary streams, however, this was not the case. In fact, there were two major floods on the tributaries in 1935.

The first of the floods occurred during the last ten days of January. Over seven inches of rain fell over the Memphis area in three days. Highway 78 (Lamar Avenue) was covered by three feet of water near Oakville, and water was up to the windows of homes in the Brooks Road and Highway 51 vicinity. The usually sluggish Wolf River became a torrent. Several small craft were sunk along the area on Riverside Drive and the bridge across Wolf River at North Second Street was washed away.[42] By the end of January, the worst of the flood was over. In Arkansas, Tennessee, and Mississippi the floods had caused an estimated damage of five million dollars and had been responsible for the deaths of twenty-two people.[43]

The second flood on the tributaries occurred in March, 1935. After heavy rains the Memphis Engineer District issued a flood warning for ten small towns. Twenty small streams were already out of their banks causing 1,000 families to move to higher ground. By March 18th, the St. Francis River had broken through the levees in eighteen places, flooding approximately 110,000 acres in the St. Francis Basin.[44] Near Greenwood, Mississippi, the levees of Tallahachie River were dynamited after private levee guards were overpowered. There were thirty-four crevasses in the White River levees and estimated 35,000 acres were flooded. The St. Francis River broke through its levees at seventy-three places, flooding about 485,000 acres.[45] According to the Memphis District Engineer, Shelby County sustained damages estimated at more than $444,000.

Because the levees were nearing completion in the Memphis District, emphasis was shifted to navigation works. However, all types of work on the Mississippi were delayed because of persistent rains and high river stages. Most of the work on the levees consisted of enlargement, more than 26.6 million cubic yards were added to the levees. During the dredging season, eight dredges and one sand and gravel dredge were operated on thirty-nine crossings from Medley Bend to Sibley Chute, between Mile 31 and Mile 387 below Cairo. In the Memphis District more than 43 million cubic yards of material was moved by dredging.

While dredging on the Wolf River in 1934, the "C. B. Reese" encountered the massive remains of some long-forgotten structure.

Among the more unusual items removed from the Wolf River snagging operations in 1934, was this 45 ton block of concrete and masonry.

Dredging by the River Commission resulted in the opening of two additional cut-offs at Tarpley and Ashbrook. Tarpley Neck Cut-off (Mile 461-472) was opened April 21, 1935. The approximate length of the pilot-cut was three miles. By June, 1936, the discharge through the cut was 91 percent of the total discharge of the river. On November 19th, Ashbrook Neck Cut-off (Mile 444-456) was opened at a cost of more than $266,000. Development of the flow through the mile-long pilot-cut was rapid. By June, 1936, the cut-off was carrying 97 percent of the river discharge.[46]

In April, 1935, the Memphis District Engineer submitted a report which recommended the improvement of Wolf River be extended and enlarged to provide a channel 7.5 feet below zero on the Beale Street river gage. The channel improvement would extend from North Second Street Road to Hindman Ferry Road and would have a bottom width of 125 feet, contingent on city officials providing rights of way and any necessary alterations to roads and bridges. On August 30, 1935, the project was authorized by the River and Harbor Act.[47]

Inclement weather also hurt the revetment and contraction work program. Only a little over 7,000 feet of bank protection was constructed by the Memphis district. Nevertheless, the program gave work to nearly 2,000 men. A considerable expense in the bank protection work involved the feeding and lodging of such a large group of workers. It was not widely publicized, but workers on the Mississippi River were among the best fed people in the United States. A typical order of supplies for only one month by the District Engineer would include ten pounds of garlic, four tons of Irish potatoes, 150 pounds of pig snouts, and 15,000 pounds of beef. An order would also usually call for 250 pounds of frankfurters, 3,500 dozens of eggs, and 425 pounds of aged American, brick, pimento and Swiss cheese.[48]

In 1935, the City of Memphis completed construction of Riverside Drive. The Corps of Engineers played an important part in this project. Before the scenic parkway was constructed, the Engineers placed the largest willow mat ever constructed on the river bank between Calhoun and Talbot Streets. Also, a large area of the bank was protected with concrete revetment. While preparing the banks for the revetment, the Engineers found tin cans, broken bottles, automobiles, and amazingly, a Frisco locomotive engine, with a little dirt and asphalt thrown in for good measure.[49]

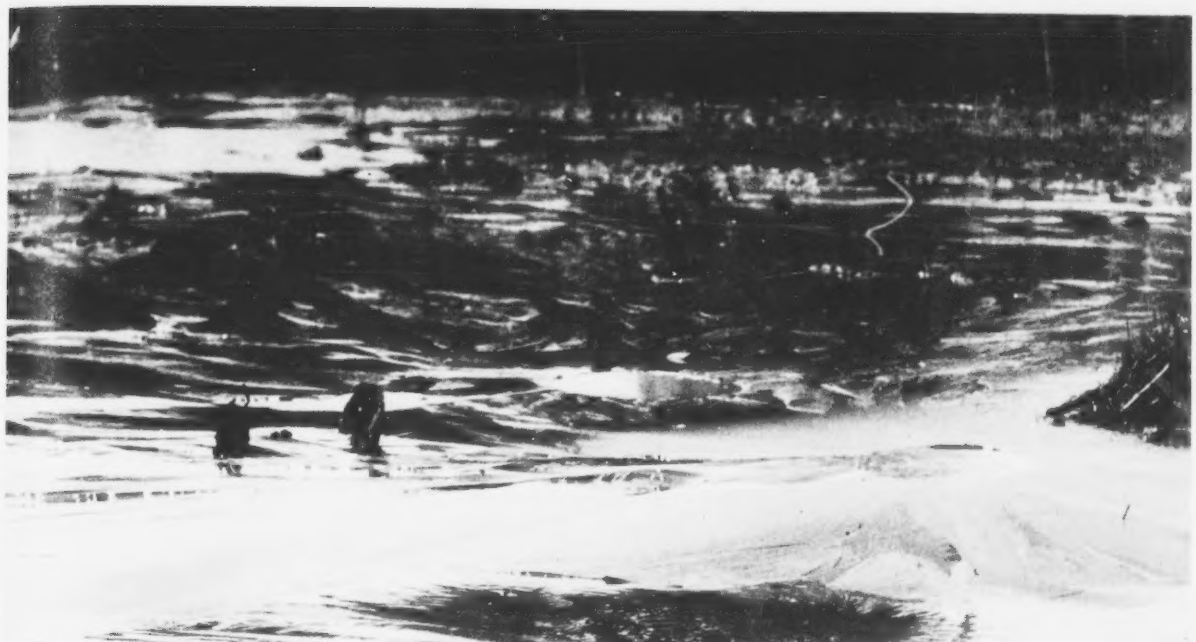
Another downward plunge of the economy in 1935 resulted in new benefits for the advocates of flood control. During 1936, the Congress, in an effort to provide more relief work for the unemployed enacted two flood control bills. The first of the two bills, sponsored by Senator John Overton of Louisiana, became the Flood Control Act of June 15, 1936. Provisions of this bill dealt only with the Lower Mississippi River. The act authorized the expenditure of $272 million on flood control. Included in the bill were flood control for the Yazoo-Tallahachie-Coldwater River System in Mississippi, new floodways on the lower Mississippi, and the expenditure of $16 million for flood control in the headwater area of the St. Francis River in Arkansas (Wappapello Reservoir).[50]

The second flood control act was entitled the River and Harbor Act of June 22, 1936. This legislation was first introduced in 1935, but had failed to receive a favorable vote. Projects authorized by the act had been developed from the "308" surveys of various river systems. Three important provisions characterized the bill. To begin, it was the first general flood control legislation in United States history, and established a national policy on flood control. Secondly, the act authorized the construction of some 250 projects and the appropriation of $310 million to initiate construction. Thirdly, numerous examinations and surveys were authorized by the act.[51] Twenty-five surveys in the Memphis district alone were authorized with a view to the control of floods.

Setting a national policy on flood control was the most important provision of the River and Harbor Act of 1936. By the terms of the act, the Federal Government would cooperate with states and local interests in flood control projects. A dual concept of flood control would be undertaken. The Corps of Engineers would develop engineering plans from the surveys, and the Department of Agriculture would initiate land treatment plans for the reduction of flood damages. No project could be constructed unless the benefits from the project exceeded the costs. Various projects could be recommended in survey reports, but could not be constructed until enabling legislation had been enacted.[52]

One of the leading forces that had advocated and pressured Congress for flood control acts was the Mississippi River Flood Control Association. The organization had played a major role in the passage of the Flood Control Act of 1928. On July 24, 1936, the organization met in Memphis to disband its operation. At the meeting were engineers and representatives from 28 levee and drainage districts. Instead of simply disbanding, it was decided a new organizational structure was needed. In the past the Mississippi River Flood Control Association had devoted its energies to flood control problems on the Lower Mississippi. This old flood control association was declared dead and a new organization known as the Mississippi Valley Flood Control Association was created with Senator John Overton of Louisiana elected the first President. Pressure for flood control works in the future would not be confined to the Lower Mississippi. The new association would encourage, promote and foster any and all matters of interest relating to flood control in the Mississippi Valley.[53]

Very little of the appropriations authorized by the two flood control acts of 1936 were made available during the year. Levee construction in the Memphis district consisted of



Sand "boils" occur when high water creates enough pressure to force passage under a levee, pushing sand before it. This picture was taken at 32nd Street, Cairo, Ill. on April 17, 1936.

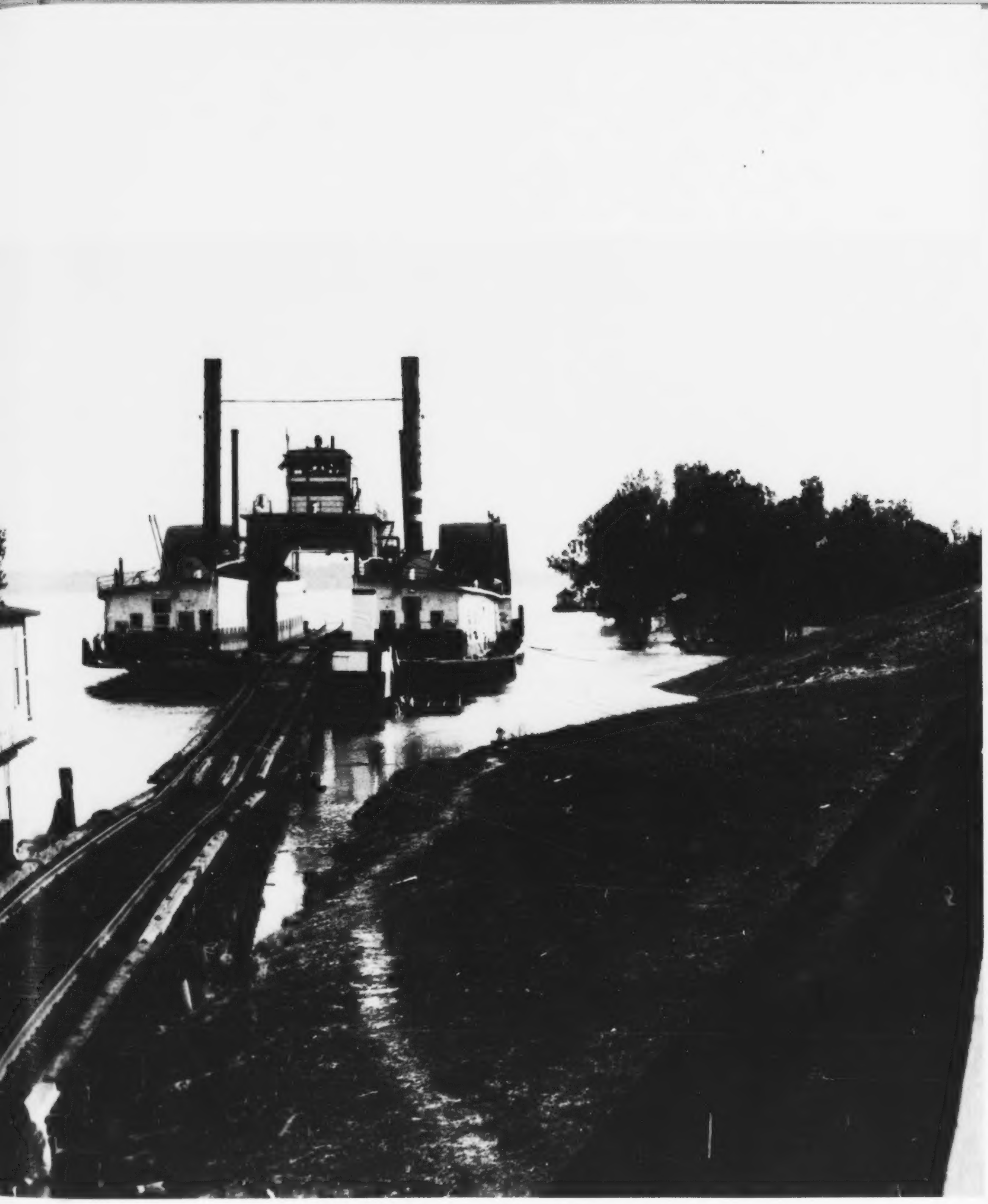
placing about eighteen million cubic yards of material on the levees and two-thirds of the levee work was confined to the Lower St. Francis Levee District. At the end of the year, the levee board could say that it was the largest levee district in the world, yet for all practicable purposes, very little levee work remained to be completed. The district levee protected approximately 1.6 million acres and was 99.8 percent complete.[54] Of the more than 594 miles of levees in the Memphis district, about 96 percent were now complete to grade and section.

Revetment work in the Memphis district during 1936 fell off appreciably. Only about 18,000 feet of revetment was constructed. No new construction works were constructed in the district during the year. The picture was not quite as bleak in the other districts. On the entire river, revetment was placed on 7.4 miles of river bank, bringing the total mileage of revetment to 143.5 miles.[55]

Dredging operations in 1936 were a major expense in the Memphis district. The dredge fleet moved more than 43 million cubic yards of material in maintaining and improving the channel of the Mississippi River. Though not a part of the Memphis district, the cut-off program continued with two additional cut-offs completed. Rodney Cut-off was opened on February 29, 1936. This cut-off shortened the river by 7.1 miles and was more successful than the Sarah Island Cut-off to be completed later in the year. Several months after its completion, Rodney Cut-off was carrying 13 percent of the total discharge of the river. A cut of 3.2 miles opened the Sarah Island Cut-off on March 23, 1936. Cost of the cut-off came to more than $410,000, but several months later the cut-off was carrying only one percent of the total discharge of the river.[56]

In 1936, the Mississippi River at Memphis remained above flood stage for twenty-five days. A crest stage of 40.4 feet was reached on April 18, but it remained at that stage for five days. This stage of the river presented few problems for the Engineers, but day and night patrols were established. Levees are routinely patrolled during periods of high water so that if any emergency arises the danger area can be identified and necessary repairs can be made with as little delay as possible. About two million acres were overflowed by the high water of 1936, but there were no levee breaks. Most of the damage in the Memphis district was in the Tiptonville, Tennessee, area. The east bank of the river in this area had no levees to speak of, but the River and Harbor Act of 1936 had authorized levees for the Tiptonville area. Between the years 1927 and 1936 the Memphis district had expended more than $1.3 million in fighting the high waters of the Mississippi.[57]

In the past eight years, the levees on the Mississippi River had received an additional 593.4 million cubic yards of dirt. Under the jurisdiction of the Mississippi River Commission there were more than 2,000 miles of levees that were about 91 percent complete. Several spillways and floodways had been constructed to increase the discharge capacity of the river and the entire flood control project in the Lower Mississippi Valley was about 90 percent complete. But before the remaining ten percent could be completed, the Mississippi River would test the Engineers' flood control project. The Engineers had said that a super flood like that of 1927 came only once in a hundred years. In 1937, the Engineers' would see another super flood, the second in a decade.



1936 picture of the train ferry at the Helena, Arkansas, Floodwall.

CHAPTER VII

The Test: The Flood of 1937

In 1937, the Corps of Engineers won its first battle with the Mississippi River during a major flood, and it may have been the battle that won the war between the river and the Engineers. Afterward, the river would continue to occasionally rear an arm of destruction, but the Engineers could look on their work with satisfaction, knowing that – while they had not tamed the river – they did have it under control.

Since the flood of 1927, the District Engineer had developed an effective flood-fighting organization against the "most sinister of all the terrors offered by nature in sullen mood."[1] The flood was predicted by the Weather Bureau, observed from planes, and reported by all means of electronic communications. Before the development of the radio, the method of spreading an alarm during periods of floods was crude, but still effective. If trouble developed, a guard would fire his gun three or four times at intervals of a few seconds, the number of shots giving some measure of the alarm. If a levee broke, a fusillade of shots would break out that lasted until the ammunition had been exhausted. People living behind the levee would pick up the sounds and repeat it until the whole area behind the levee had been warned. In addition to the firing of guns, plantation bells were used to send messages of a levee break for many miles and in a short period of time. Even today, the city of Caruthersville, Missouri, has a large bell at the entrance to one of the floodwall gates.

The flood of 1937, was a "super flood" according to the Corps of Engineers. It was produced almost entirely from the Ohio River. Below the mouth of the St. Francis River, very little was contributed to the overflow by the tributary streams, a major difference from the flood of 1927 waters were augmented by heavy rainfall below Cairo and the Ohio contributed little more than its normal discharge into the Mississippi. In 1937, it was the Ohio River that became the real culprit.

On January 1, 1937, rains over the Cumberland and Tennessee River basins pushed the Ohio River to near flood stage. Then the unusual occurred. The Weather Bureau was noting an unstable atmospheric condition as a large stationary high pressure system (cold air) became stalled over an area from the Upper Mississippi Valley to the Pacific Coast. While off the eastern coast, another large high pressure cell was situated over the Bahamas. Between these two cold air masses came a tropical flow of air, saturated with moisture. The meeting of the warm and cold air eventually dropped 165 billion tons of rain on the Mississippi Valley north of Memphis and in the Ohio Valley. Thus, the 1937 flood was born.[2]

On January 15, 1937, Lt. Col. Eugene Reybold, District Engineer, sent a memorandum to district personnel stating that a major flood was coming. The river was still three feet below a flood stage of 34 feet, the new flood stage computation down from the previous 35 feet. An organizational plan for fighting such a flood had already been developed. This plan consisted of dividing the Memphis Engineer District into four field areas: the First Field Area, an area from Cape Girardeau to the Missouri-Arkansas state line, with offices in Cairo; the Second Field Area, the Lower St. Francis levee from the

Arkansas-Missouri state line to the mouth of the St. Francis River, with headquarters at Memphis; the Third Field Area, the Upper Yazoo levees, White River levees and Arkansas River levees, with headquarters at Helena; and the Fourth Field Area, with headquarters at Memphis, consisting of all the levee above the influence of the Mississippi River.[3]

Levees on the St. Francis River crevassed at six different places near Kennett, Missouri on January 19th, flooding about 50,000 acres. The next day, the Mississippi River at Memphis passed the 34 foot flood stage. With water lapping at the edge of Riverside Drive, the Weather Bureau reported that the river would go to 40 feet within the next few days and that the first twenty days of January had been the wettest since 1882. Rainfall for the period had been more than eight inches, five inches above the normal.[4]

On January 22nd, a 180-man unit of the Tennessee National Guard was ordered into service to patrol the levees near Tiptonville because rumors indicated that a group of citizens were planning to dynamite the levee. That same day, the District Engineer notified the Dredging Section that it would have the responsibility for evacuation of the flooded areas between Cairo and the mouth of the White River. Immediate steps were taken to implement the directive and the river was divided into four sections. A towboat, a

Aerial view of Cairo, Illinois, in a not unfamiliar condition of water siege.

dredge, or a permanent office, if located at a strategic point, was to be designated as a base of operations. Reports on conditions in each area were to be sent to the Dredging Section Office when radio or telephone service permitted and Red Cross officials were to be notified of the point of delivery of refugees. Subsistence and emergency medical treatment were to be provided while the refugees were being taken to points of delivery to the Red Cross.[5]

On January 24th, the District Engineer distributed another memorandum giving an estimate of the situation. Reybold stated that it was his belief that a peak discharge of 2.5 million cubic feet per second would take place at Cairo. The minimal discharge figure was estimated at 2,225,000 cubic feet per second, and such a discharge would produce a stage of 61 or 62 feet at Cairo. Reybold directed that the floodfight on the St. Francis River be turned over to local officials and ordered all district personnel to return to Memphis to fight the flood on the Mississippi, reporting that the situation in the upper part of the district was grave. Drastic efforts would be required if the area was to be saved; monetary considerations would not be a factor, and normal procedures in securing manpower and supplies were to be forgotten. He ordered his men to "sack up" the levees for a possible 62 feet on the Cairo gage with the New Madrid floodway in operation, 55 feet at Memphis, and 66 feet at Helena. He believed that the crest predictions could not be relied on at the time; and under any conditions it was best to be prepared for all contingencies.[6]

On the same day the memorandum went out, a call for a highwater conference at Memphis to be held on January 25th was sent out to interested officials. Representatives of levee boards, railroads and highway departments attended the meeting. A member of the Mississippi River Commission also attended the conference.

The conference opened with Col. Reybold announcing that the super flood was on its way. Stating that his mission was to maintain the integrity of the levee system, it was agreed that the levees must be raised. Water coming down the Ohio River would present a problem of hydraulics in which conjecture would be the only possible way of assessing what might happen. Thus, the group was told to raise their levees for a possible 62 feet at Cairo, a possible 55 feet at Memphis, and a possible 66 feet at Helena.[7] At this point in the meeting, several reporters from the local newspapers – sensing a big story – headed for their typewriters. They reported that a massive flood of unknown proportions was on its way. They reported that three would *be* 55 feet of water at Memphis, not a *possible* 55 feet.

Newspapers the next day carried the news of the anticipated flood in banner headlines, reflecting the greatest possible danger. But some cities refused to believe that such a flood was on its way. Officials of Greenville, Mississippi, who had suffered so much during the 1927 flood, were critical of the District Engineer. It was their contention that the Engineer was retarding the economic development of the area by creating fear in the minds of the people of the Valley and those outside the Valley who wished to take part in the development of the Valley.

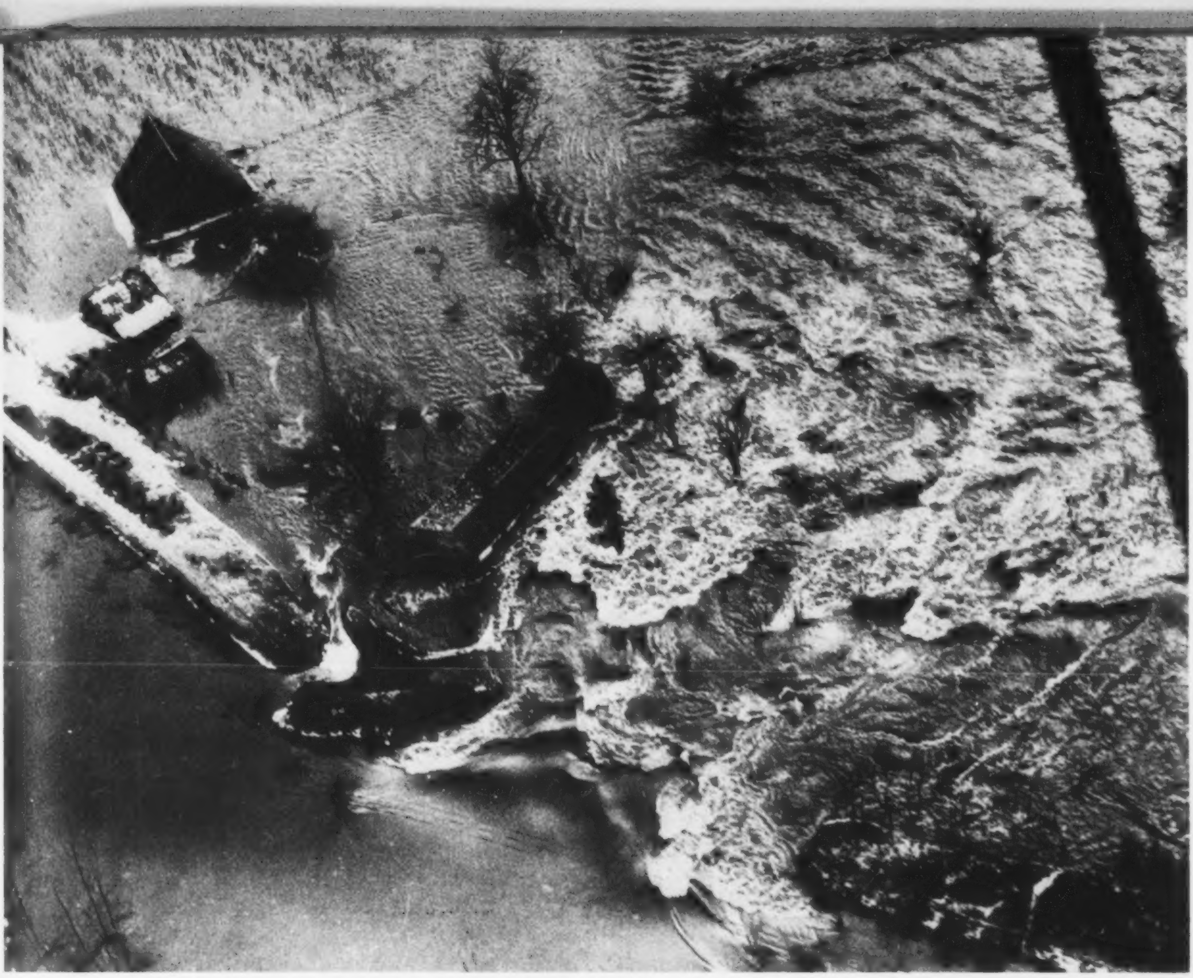
Even before the highwater conference Col. Reybold had decided that it was highly probable that the Birds Point - New Madrid Floodway would be placed into operation. The floodway had been created as a part of the project adopted by the Flood Control Act of 1928. Its purpose was to reduce the stages at Cairo and protect the city by permitting additional flow through the floodway area. Designed to carry 400,000 to 500,000 second feet, the floodway had been formed by constructing a setback levee from Cairo to New Madrid, ranging from four to ten miles west of the front line levee as it existed in 1928. The floodway would draw off enough water to reduce the projected flood to 59 feet at Cairo.

Major R. D. Burdick, Memphis Engineer District, was given the assignment of placing the floodway in operation. On January 20th, rains fell over the Ohio Valley making any crest predictions impossible but, with the additional rain, it seemed inevitable that operation of the floodway would be necessary. The Mississippi River Commission advised the Memphis District to evacuate the territory within the floodway.[8] On the afternoon of January 21st, WMC and WREC, Memphis radio stations, were requested to broadcast a notice that the Floodway must be evacuated. Hundreds of handbills giving notice of the evacuation were ordered printed and distributed in the area.

In the meantime, the integrity of the front line levee would have to be maintained until a gap in the setback levee, where the Missouri-Pacific Railroad entered the floodway, was closed. Also, the front line levee would have to be maintained until a definite decision was made on the operation of the floodway. The situation at Cairo was watched closely during the day of January 23rd, by the Operations Office of the District Headquarters. By late afternoon, the river at Cairo stood at 56 feet and was rising a tenth of a foot per hour. Attention was riveted on the fuse plug that would automatically overtop and operate the floodway. The plug was designed to crevasse when the river stage reached 57 feet at Cairo.

It was soon apparent that the natural operation of the floodway would be too slow to keep the stage at Cairo below 60 feet, and Major Burdick recommended to the District Engineer that artificial crevasses be made in the fuse plug levee to insure its proper operation. The District Engineer then ordered Major Burdick to proceed to Cairo and place the floodway in operation. While Major Burdick was in route to Cairo, the District Engineer ordered personnel in the area to take pick and shovel to the fuse plug area and cut ditches through the fuse plug. It was hoped that the scouring effect would produce adequate crevasses.

When Major Burdick arrived at Cairo on the afternoon of January 24th, he was told by the men attempting to crevasse the levee by trenches that it would be impossible to crevasse the levee without the use of dynamite. It was reported that several farmers living inside the floodway were even building up sections of the fuse plug to save their land and would forcibly try to prevent the opening of the floodway. Major Burdick requested that a company of the Missouri National Guard be sent to the area to protect the men putting the floodway into operation.[9]



This aerial view is of a planned crevasse in the Birds Point-New Madrid Floodway. The resident of the inundated farm understood the situation, and asked only time to take his chickens to safety. Flood of 1937.

Several problems were immediately encountered. Several times the work had to be halted while men went on rescue missions. Dynamiting at one position was stopped because an old man with frozen feet and an elderly lady with two crates of chickens were so near that they might be injured by the blast of the dynamite. Another problem was the weather. On January 9th, 21st, and 22nd, ice storms had covered most of the area and knocked out the telephone and telegraph lines. The sleet from the storms covered highways and country roads to an average depth of six inches, and it was next to impossible to negotiate the bank of any levee covered with six inches of ice.[10]

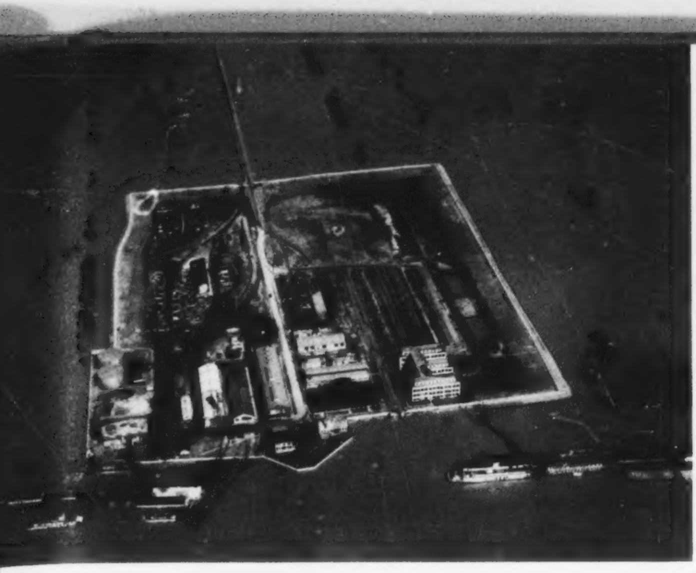
The citizens living inside the floodway created one of the most serious problems. District Engineer Reybold reported that efforts to place the floodway in operation were being prevented by armed inhabitants patrolling the levee. He requested that two companies of the regular army replace the National Guard because they were reluctant to give the military assistance. One story of "armed resistance" demonstrates the imagined as well as the real problem: an old hunter and trapper by the name of "Budge" Cobb lived in the floodway and figured to capitalize on the high water. Cobb knew that when the floodway was opened all the rabbits would make their way to the levee for safety, ahead of the flood water. He was patrolling the levees picking off the rabbits with his gun when the first dynamiting party arrived. Seeing a man with a gun on the levee, the dynamiting party moved to another location.

After a while they heard gunfire and saw "Budge" Cobb running their way. Not knowing that he was only hunting rabbits, the workers returned to Cairo to await reinforcements. Some say that this delay in opening the floodway probably saved the lives of several people who had not been able to evacuate the area.[11]

After receiving large quantities of dynamite, Major Burdick prepared to open the floodway on January 25th. A crew was assembled and made their way to the first area to be opened. Three areas were selected for crevassing. At position one, 1,000 pounds of dynamite was placed in three rows of three holes each. The charge was exploded creating a crevasse seventy feet in length. The party moved upstream about 300 feet and placed 950 pounds in the same manner. This charge created another crevasse fifty-eight feet in length. The party of workers then moved on to position two. There, two charges – 1,100 and 1,000 pounds – were placed 300 feet apart. These two blasts created crevasses of sixty and thirty feet. But Major Burdick decided that these crevasses were not enough. He sent a telegram to Memphis requesting an additional 20,000 pounds of dynamite. The Memphis Office sent the dynamite, but 4,000 pounds failed to arrive in time. On January 26th, seven more crevasses were made at position two while another party of workers made three crevasses in the same manner at what was called position three. In all, fourteen crevasses were made with a total length of 2,140 feet.[12] The effect at Cairo was dramatic, as the flood stage was immediately reduced by 3.5 feet.

Opening of the Birds Point - New Madrid Floodway was marred by two accidents. One tragedy grew out of the obstinacy of inhabitants refusing to evacuate the floodway: it was reported that three people were drowned and at least four others were missing.[13] The second tragedy involved the sinking of a barge when it went down. The exact total of deaths could not be established because it was not known how many men were on the barge. Twenty-six bodies were reported found, but there was no way of knowing if this was an accurate count.[14]

During the 1937 Flood the city of Memphis joined in with Shelby County to sustain the cost of constructing an emergency sandbag levee. The effort was successful in holding back the floodwaters of the Nonconnah Creek. Feb. 10, 1937.



The Memphis District Engineer's Reservation, at West Memphis, Arkansas, surrounded by the floodwaters of 1937, but protected by its own levee system and functioning at full capacity.

The Corps of Engineers waged a relentless battle against the flood of 1937. Although not one portion of the main line levee system was breached by the floodwaters, there were some anxious moments at several places. The Mayor of Cairo ordered the city evacuated. There were no breaks in the levee system, but sand boils and seepage presented numerous problems. Sand boils were ringed with sandbags to equalize the pressure and stop the flow. One company offered the Engineers a ton of dry ice for an experiment to determine the possibility of freezing sand boils. The company was notified that the flood fight was too intense to experiment at the time.[15]

Several minor problems arose in the flood fight. The river stages were so high that supply boats had trouble getting up and down the river because some of the power lines across the river were too near the water to allow the boats to go under. The same problem with some of the bridges also prevented free movement of supply boats. Near Cairo, the water almost covered Highway 51 and the state highway department had to place sandbags on each side of the highway and bring in two pumps. Water rose in this area when the operation of a pumping station was held up because there were no fuses available for the electrical equipment.[16] Efforts to use amphibious airplanes for flood work near Hickman, Kentucky, were halted because the pilots were afraid to land on the river in the midst of heavy debris. They were also afraid to land in the backwater areas because of the unknown depth of the water.[17] Trains now presented a problem for the levees. All trains traveling near levees were ordered to slow to fifteen miles per hour since higher speeds caused vibration which could undermine the levees during high water.

The Engineers also had problems with WPA and CCC camps over conflict of authority. The foremen of these two groups, knowing nothing about flood fighting, would withdraw their men at the first signs of danger on the levees and they refused to allow the Corps representatives in the area to determine when the levee was beyond saving. This problem was finally resolved in favor of the Corps, but several areas of the levee were abandoned before there was any need to do so because of the lack of immediate labor.[18] Efforts to keep the flood waters out of Hickman, Kentucky, were interrupted because employees of the WPA refused to work until they were granted the same pay as employees of the Engineers.[19]

The floods of 1937 caused 244 deaths. Twenty-states were affected and more than 85,000 families were aided by rescue and transportation to shelter. Total relief expenditures were more than $31 million.[20] Red Cross officials furnished chewing and smoking tobacco, plus snuff, to all men engaged in fighting the flood. During the first week of the flood, 60,000 refugees poured into Memphis. The Fairgrounds were set up to receive the refugees, but the number became

The Great Flood of 1937 brought some anxious moments to Memphians, especially to the industrial areas along Wolf River and Nonconnah Creek. In some instances factory walls were reinforced as floodwalls, and in other instances, as depicted, sandbag floodwalls were thrown up in desperation.

so great that fourteen schools were ordered closed in order to provide shelter for the flood refugees.[21] While the refugees were not a happy people, they made the best of a bad situation. Refugees at the Fairgrounds sang the "High-Water Blues." And when Memphis

Down at the Fairgrounds on my knees,
Praying to the Lord to give me ease –
Lord, Lord, I got them high-water blues!

Political "Boss" Ed Crump made an appearance in high-topped boots they quipped.

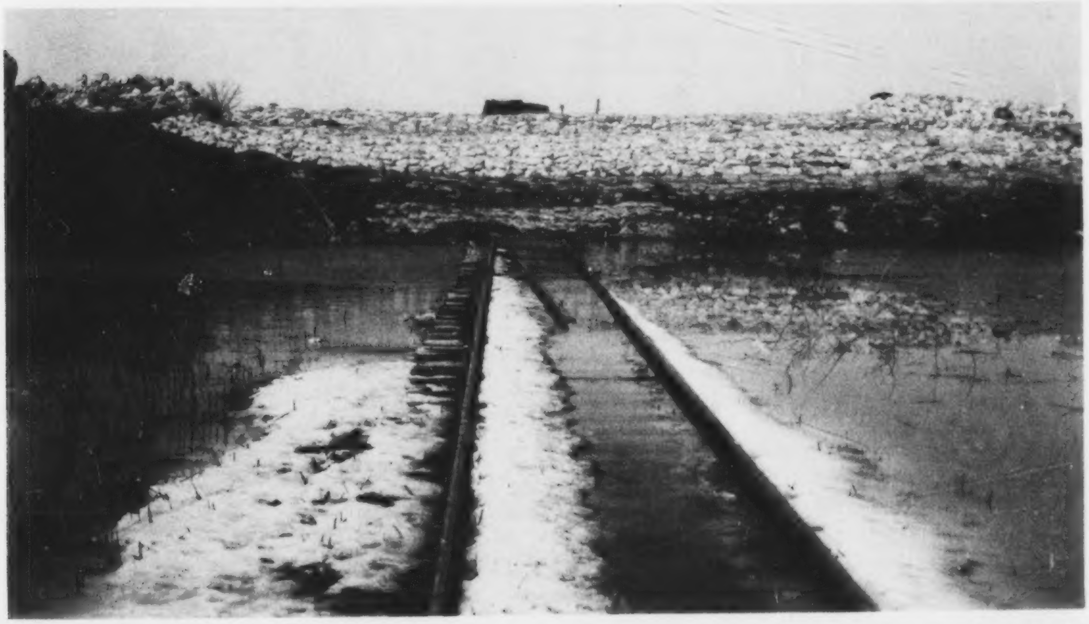
Oh, the river's up and cotton's down,
Mister Ed Crump, he runs this town.[22]

A part-time employee of the Engineers, Mr. S. A. Denison, came rumbling across Harahan Bridge in an old truck loaded with a steel casket. When Red Cross officials asked him whose body was in the casket, he reported that it was the body of Hernando DeSoto. Mr. Denison had found the casket several months before and had been making "easy money" by charging admission to see the body. His place of business was a beer hall located in the bottoms across from Memphis. Red Cross officials put Mr. Denison and his casket in a vacant store building with other refugees and there he was seen sleeping with "Hernando," taking no chance on losing his investment. The flood of 1937 had washed away his place across the river, forcing Denison to set up his business in Memphis; but the city people were a little more sophisticated than the bottomland saloon patrons had been. Business lagged and, finally, Mr. Denison's partner assumed possession of "Hernando," taking it north where it was hoped that greater profits could be made.[23]

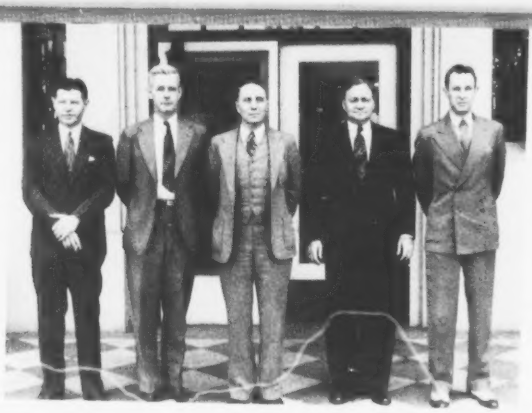
Cold weather, mixed with sleet and snow, made rescue efforts extremely hazardous. Rescue workers reported finding a woman and her newborn infant frozen to death on the roof of a water-surrounded farmhouse[24] and Carl Hunt, a U.S. Engineer, was found frozen to death near the levee in Mississippi County, Arkansas.[25] At Frankfort, Kentucky, twelve prisoners were killed in a riot at the Kentucky State Prison when terrified prisoners felt the floodwaters creep into their unlighted cells.[26] Fourteen people were drowned at Paducah when a rescue barge capsized in the flood water. Also at Paducah, another threat of death and destruction arose in the form of floating gasoline, caused when a 20,000 gallon tank upended as it tumbled down its mooring. The threat was ended when the gasoline ignited and burned itself out.[27]

From January 22nd until January 26th, the Memphis Engineer District was actively engaged in rescue work. At noon on the 26th, the Engineers notified the Red Cross that – because of the acute situation on the levees – it would be necessary to transfer responsibility for all rescue operations to the Red Cross. During the height of the flood fight, the Red Cross had over 54,000 personnel engaged in rescue efforts. A total of 7,272 boats of various kinds were used in rescue work[28] and many private citizens turned their boats over to the Red Cross for use in the operation.

One such speedboat owner volunteered his boat and his services for expenses, which included both gas and whiskey. The boat, with a cargo of northern newspapermen, went roaring off down a canal created by a submerged road. But the boat wandered off course, no doubt due to the whiskey, and impaled itself on the flooded upper girder of a small iron bridge, the impact ripping a hole in the bottom of the boat. The occupants were finally rescued, very cold and very wet. Nevertheless, it made a great story, often improved by many embellishments.[29]



When the Great Flood of 1937 threatened the integrity of the front line levee of the Birds Point-New Madrid Floodway, the setback levee became critical. The Missouri Pacific Railroad served the floodway interior through a gap in the setback levee, thus the Mo-Pac had to be sealed off to complete the setback levee line. Note the top of a boxcar on the land-side of the levee.



District Engineer Major David Noce, flanked by staff. Major Noce, now General Noce, was one of the most popular as well as efficient District Engineers, and served from 1937 to 1940.

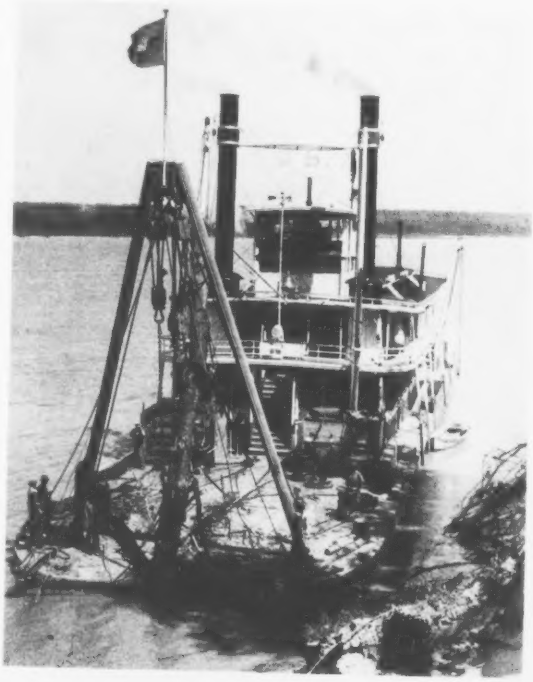
By the end of February, 1937, the worst of the flood had passed out of the Memphis Engineer District. General Edward M. Markham, Chief Engineer, had pithy words for the amateur river experts, as he claimed there was no basis for the hysteria generated by those so-called river "experts."

> If the people who know nothing about flood control had kept their mouths shut, there would have been none of the hysteria or fear that swept some communities of the Valley, created by tourist engineers and others who desire to see their names in the papers.[30]

One last operation remained, the closing of the Birds Point - New Madrid Floodway before the usual spring rise could begin the Memphis Engineer District moved more than 4,000 men to the area and they worked with earth-moving machines, tractors, trucks, scrapers, and sand bags. They constructed a ring levee, the largest emergency levee of its kind ever built in the United States. This levee held off the rising waters and saved crops that had been planted in the floodway since the big flood of January-February, 1937.[31]

District Engineer Daniel Noce reported to the Mississippi River Commission that the district had used 8.5 million sandbags, and had spent more than $2.3 million during the high-water fight of 1937. It had ultimately cost more than $1.8 million to open and close the Birds Point - New Madrid Floodway and property inside the floodway had sustained damages amounting to some $33,000. Noce reported that 3,840,000 acres had been flooded in the Memphis Engineer District with property damage and other losses coming to more than $6.2 million.[32]

Although the flood of 1927 did more damage, during the flood of 1937 the river reached a higher stage and carried a greater volume of water. Fortunately, the levees constructed under the Flood Control Act of 1928 were able to contain the flood. The final chapter in this successful battle was written with the disposal of leftover sandbags, johnboats, rubber boats, raincoats, and similar items. All materials were sold to the highest bidder, except for the johnboats, which were given to various levee districts.



Snag Boat "C. B. Reese" at work. The design and concept is unchanged from the original design of Capt. Henry Shreve, who offered his invention to the Engineers in 1824.

The "Osceola" was typical of the old sternwheel workboats utilized for so long in the Memphis District.

CHAPTER VIII

A Two-Front War: 1937-1945

The 1937 floods in Ohio and Mississippi Rivers gave convincing evidence that even greater flood protection was needed. The floods also pointed up the need for some type of protection from backwaters of the Mississippi. The floods proved even more conclusively that the tributaries of the Mississippi were in greater need of attention than any other area of concern. If the tributary streams could be controlled it would serve a dual purpose: (1) It would provide flood protection to the adjacent areas and (2) the volume of water discharged into the Mississippi could be regulated.

The determination to concentrate on the tributaries brought an overwhelming scope of new activities to the Memphis District. The inclusion of some massive undertakings demanded that the Memphis District be subdivided and reorganized, as its existing boundaries extended far into Oklahoma. In order to promote more efficiency, the great western sector of the District was alienated into a newly re-recreated Little Rock District and, at the same time, a Southwestern Division was created with headquarters at Dallas. In the reorganization of the Memphis District, the Arkansas River and its tributaries above the city of Pine Bluff were withdrawn from Memphis jurisdiction, as was the White River and its tributaries above Peach Orchard Bluff. This action left the Memphis District with its present boundaries.[1]

During the height of the floods of 1937, the House Flood Control Committee passed a resolution calling on the Corps of Engineers to submit an updated, comprehensive, national flood control plan. Army Engineers had been gathering data for such a plan for several years, therefore, in a matter of months they were ready with a proposal. Their report provided for a variety of national flood control projects at an estimated cost of $800 million. President Roosevelt received the information from the Engineers with mixed feelings. Roosevelt sent the report on to Congress, but asked that it be returned because he was not ready to support a long-range plan until additional data became available.

City officials of Memphis supported the move for new flood control legislation in the hope that protection from Wolf River and Nonconnah Creek would be included in any subsequent legislation. Wolf River and Nonconnah Creek had always caused some damage during periods of high water. In 1903, the city had begun to construct levees along Wolf River to prevent overflow of low lying areas. This protection work provided safety to the northern section of the city, which for a time, had seen floodwaters even on several blocks of Main Street.[2]

After the two floods of 1912 and 1913, the city instituted a project to improve the North Memphis levees. Levee heights were increased and a pumping station was constructed along Bayou Gayoso. South Memphis received protection when a levee was constructed along Nonconnah Creek. In 1937, however, the flood demonstrated the inadequacy of the project. Only by a determined fight was the flood kept out of the northern and southern parts of the city and, even with the fight, the city sustained damages amounting to more than $1.3 million.[3]

In April 1937, the Corps of Engineers presented a plan of protection for Memphis, and the River and Harbor Act of August 28, 1937, adopted the project. The flood protection scheme for Memphis included a coordinated system of levees, floodwalls, and bank protection. About 22,000 feet of levee and flood gates were constructed on the right bank of Nonconnah Creek, extending from its entrance into Tennessee Chute to near Bodley Avenue. Protection from Wolf River consisted of the construction of about 14,000 feet of concrete flood wall and about 32,000 feet of earth levee on the left bank of Wolf River, extending from near Jefferson Avenue to high ground at new Douglass Park.

The plan also provided for the construction of six pumping stations and eight storage reservoirs for the disposal of drainage water. Cypress Creek Reservoir was enlarged and a culvert under North Bellevue was constructed. The project gave the northern and southern sections of the city protection from a project flood of 54.5 feet on the Beale Street gage. A crest stage of 50.4 feet had been reached on this gage during the flood of 1937. In 1939, the project was amended to provide that the Federal Government assume the cost of the pumping stations and outlet works for interior drainage.[4]

Work in the Memphis Engineer District during 1937 was delayed for several reasons. First, extreme river stages suspended actual construction work. Secondly, the flood of 1937 resulted in a review of the entire Mississippi River and Tributaries Project with a view to providing additional protection. Thirdly, the Memphis District was involved in gathering data and devising new methods for protection from floods similar to that of 1937.

Bank protection work almost ground to a halt in 1937. Only 3,949 linear feet of new revetment was constructed. Most of the revetment work consisted of repairs and renewal of old revetment work.[5] No new contraction works were constructed during that year. Levee construction in the Memphis District revealed the same story. Only about 4.2 million cubic yards of dirt was added to the main levees. Several thousand cubic yards were added to the levees on the tributaries as repair work under the flood control project adopted in 1928.[6]

Dredging operations in the Memphis District resulted in the movement of more than 41.6 million cubic yards of material. This work included the dredging of 53 crossings, improvement dredging of six locations, levee construction, and maintenance dredging in Memphis Harbor and Wolf River.[7]

During fiscal year 1937, the River Commission continued its construction of cut-offs. Since 1932 the cut-off program had been pushed to the utmost degree that available dredges would allow. At the end of 1937, there were 32 known artificial and natural cut-offs on the Lower Mississippi, 20 of which had occurred before 1929. As a result of the 32 cut-offs, the river had been shortened by 354 miles. Caulk Cut-Off, the 32nd cut-off, was completed in 1937. Work there (Mile 406-422) was begun in April, 1937, and was completed by May 13th, 1937. More than 1.5 million cubic yards of material had been removed by two dredges and a levee machine, resulting in a cut-off approximately eight-tenths of a mile long. Caulk Cut-Off was slow to develop and, one year later, was carrying only three percent of the total discharge of the river. The cut-off had cost more than $183,000.[8]

By action of Congress in 1938, the Mississippi River and Tributaries Project was again amended. The Flood Control Act of June 28, 1938, authorized $375 million in flood control projects for a variety of river basins. In reference to the Lower Mississippi, the act modified the flood control project pertaining to floodways and outlets. In the Memphis District, the act included improvement and regularization of the Mississippi between Cairo and the Arkansas River. Congress authorized an appropriation of $40 million to initiate the program.[9]

The many flood control acts passed in the previous years and again in 1938 swamped the Memphis District with work. Special area sections, established within the District office, were devoted to the planning and construction of the St. Francis River and Memphis flood control projects. Plans for two of the eight sections of the Memphis project received approval by the Chief of Engineers in August, 1938. The approved sections were the Nonconnah levee and a levee between Thomas Street and Payne Avenue for protection from Wolf River. More than two million dollars was allocated to begin construction. However, actual construction was delayed because city officials were unable to gain immediate rights-of-way in the two sections.[10]

A comprehensive plan of flood control for the St. Francis River had been approved by the Flood Control Act of 1936. Plans for the project were approved by the Chief of Engineers in May 1937. Problems with land acquisition in the project area delayed actual construction for several months, but in August, 1938, the War Department ordered construction on the project be initiated.[11] The project included a dam and reservoir at Wappapello, Missouri, leveed floodways along the St. Francis River, a siphon at Marked Tree, and channel improvement on the Tyronza River.

Control of floods on the St. Francis River was one of the most ambitious projects ever undertaken by the Memphis Engineer District. The project contained two features never before tried in the Memphis District – a reservoir and a siphon. Wappapello Dam and Reservoir derived its name from the small community of Wappapello, Missouri in Wayne County. The dam is located about 16 miles northeast of Poplar Bluff.

Wappapello Dam was designed to control the runoff from about 1,310 square miles of Ozark uplands. The dam created a reservoir of 625,000 acre feet capacity and was designed to hold the floodwaters of the St. Francis and to release them in such a manner as not to exceed the capacity of a leveed floodway below the dam. When finished the earthen dam was 2,700 feet long at the crest and a maximum height of 109 feet. More than 2.7 million cubic yards of dirt was used to construct the dam and its salient features. The upstream portion of the dam was protected by placing a layer of sand and gravel to act as a filter. A three-foot layer of riprap protected the face. Riprap was also placed on the downstream slope of the dam.[12] Wappapello Dam created an additional benefit as a recreational site. Hunting, fishing, boating, and camping are among the many resultant activities enjoyed by millions of visitors each year.

The St. Francis project plowed new ground in flood control and world-wide attention was brought to the Memphis District by one engineering feature of the project – the

Wappapello Dam under construction. View of the control structure under construction. View looking South from upstream end, with Diversion channel in foreground. Wappapello reservoir is located 310 miles up the St. Francis River.

Wappapello Dam, completed. View shows control structure and a part of the reservoir which has now become a recreational focus of the area.

Marked Tree Siphon. This huge siphon made it possible to pass water over a leveed section of the St. Francis River.

The siphon idea evolved quite naturally: In the 1920's, local drainage officials had constructed a levee across the St. Francis to create a floodway. The floodway was designed to divert the floodwaters of the river past Marked Tree and then to re-enter the river about 15 miles below Marked Tree. Because the St. Francis was a navigable river, a lock and sluiceway were provided. The sluiceway failed to operate many times in subsequent years and, in 1938, its failure to operate had resulted in inundation of the area. Major Daniel Noce, District Engineer, while on an inspection trip in the New Orleans District, noticed that the large water mains of New Orleans crossed over the levees instead of going under them. From this he conceived the idea of a siphon over the levee at Marked Tree as a way of eliminating the sluiceway. Upon returning to Memphis, Noce put his engineers to work on the design of such a siphon. A careful search was made for siphon engineering advice, but no "expert" could be found in any of the departments of government. Some information on intake and outflow of stilling basins was obtained from the New Orleans Water Department, but the Memphis District must be given credit for developing the siphon.

The Marked Tree Siphon consists of three tubes, each nine feet in diameter and 288 feet long. Each tube conforms to the shape of the levee and is supported by concrete cradles. An

Aerial view showing the old Marked Tree lock, now defunct, and the Mark Tree siphon, a spectacular engineering success.

inlet basin on the north side of the levee and an outlet basin on the south side of the levee were constructed. A pump was provided to prime the siphon by the removal of air inside the siphon. A wooden trestle provided levee access from one side to the other. When the siphon is in use, water is taken from the floodway and siphoned over the levee into the St. Francis River, thereby lowering the level of the floodway. A second benefit was that the water taken from the floodway provided a deeper navigation channel in the St. Francis.[13]

The Marked Tree Siphon, constructed at a cost of approximately $214,000 proved to be an engineering wonder. Engineers from England, France, and South America came to observe it in operation. It proved to be more than 100 percent efficient. This at first appears to be impossible, but upon closer inspection the reason can be explained. Once the siphon had been primed and water began to flow through the large tubes, the velocity of the flow is increased from the time it enters the inlet to the time it is exhausted from the outlet. Thus, at the outlet more water is being exhausted than is being picked up at the intake. As the water entered the siphon, a rifling effect, much as a bullet traveling a gun barrel, is created. The rifling or vortex effect of the water passing through the siphon increases the speed of the flow, therefore, it had a higher rate of flow discharge than that being picked up at the intake. The siphons are designed for lifts of 15 to 28 feet and for a normal flow of 2,600 feet per second, with design discharges for the heads ranging from 600 to 1,800 cubic feet per second.[14] The overwhelming success of the siphons has attracted world-wide attention as a truly unique engineering feat.

Work on the St. Francis project filled a vacuum that had developed in other flood control work on the Mississippi. The Memphis Engineer District constructed no new revetment or contraction works during fiscal 1938. Repairs of existing work consisted of replacing about a million square feet of revetment.[15] The same condition existed in levee construction as only about 4.3 million cubic yards of material was added to the levees.[16]

The Flood Control Act of 1936 had authorized the construction of levees on the White River in Arkansas. This project, consisting of about 41 miles of levee, was designed to protect approximately 149,000 acres from inundation. Though still in the planning stage, the finished levee would contain about 32 million cubic yards of earth. During 1938, plans and specifications for the levee line were completed and construction initiated.[17]

With Emergency Relief Act funds, the Memphis District made additions to the levees on several tributary streams. General improvements of the Supply and Repair Depot at West Memphis were also accomplished with emergency relief funds. In addition, the channels of the Obion, Hatchie, Forked Deer, and South Fork of Forked Deer Rivers, all in West Tennessee, were cleared of snags and other debris during the year.

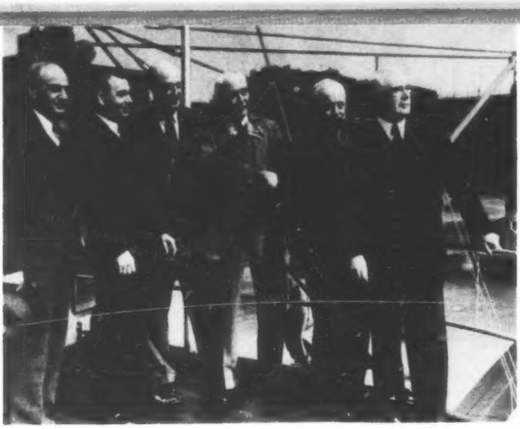
Grading a bank in preparation paving and revetmen using the hydraulic method at Sunflower cut-of December 4, 1940.

In September 1937, the District Engineer submitted plans for cut-offs below Memphis at Jackson Point and Sunflower. In February 1938, the Chief of Engineers and Secretary of War approved the plans. Removal of trees and other obstructions in the area of the pilot cut-offs were begun in March. At this point trouble over land acquisition developed with the Jackson Point cut-off. The Mississippi Valley Timber Company and Arkansas Timber Company objected to the taking of their land for the pilot cut. Condemnation proceedings against the two companies were instituted and a period of ligitation insued.

During court proceedings, numerous objections were voiced against the construction of cut-offs. On October 24, 1938, the Chief of Engineers ordered the District Engineer to suspend any plans for cut-offs above the Arkansas River and stipulated that all approvals for such cut-offs were revoked. Work on clearing the proposed pilot cuts could continue until a reasonable stopping point had been reached. The revocation of authority halted the plans for six cut-offs in the Memphis District at Donaldson Point, Slough Neck, Little Prairie, Walnut, Jackson Point, and Sunflower.[18] Construction of cut-offs in the Memphis District was thus delayed for several years.

In 1939, the Memphis Engineer District had five key flood control projects under construction. These projects were the St. Francis work, White River backwater levees, Tiptonville-Obion River Levee, and the North Little Rock to Gillett, Arkansas levee project. The St. Francis project, estimated at the time to cost about $21 million, was the most ambitious undertaken in the Memphis District in several decades. Wappapello Dam, Marked Tree Siphon, and about 277 miles of levee on the St. Francis and Little Rivers were its main features. By June, 1939, Marked Tree Siphon had been completed. The first contract for Wappapello Dam and Reservoir had been awarded in August, 1938, and by the middle of 1939 the dam and reservoir was about 17 percent complete.[19]

Work on the Memphis flood control project was being pushed with vigor. The plan was modified in 1939 to provide that the cost of providing pumping stations and interior drainage work be made a Federal obligation. Designed to protect about 5,000 acres, the project was started with section eight of the plan. Other sections were still in the planning stage.[20] The White River backwater levee was located in Phillips, Monroe and Desha Counties in Arkansas. Forty-one miles of levee would protect this area from all but extreme floods. During extreme floods, a fuse plug levee would allow the area to be flooded, thus reducing stages at other locations. The Tiptonville-Obion levee was about 15.4 miles long and located on the east bank of the river.



Mississippi River Commission on High Water Inspection Trip, May, 1939. Left to right: General H. B. Ferguson, Rear Admiral Leo O. Colbert, Mr. Albert L. Culbertson, Mr. Edward Flad, Col. R. G. Powell, and Mr. Harry N. Pharr.

When finished, this levee would give protection for Tiptonville, Ridgely and several smaller towns in Lake, Obion and Dyer Counties in Tennessee.

A part of the North Little Rock to Gillett levee was being constructed by the Memphis District. Work on the levee from near Altheimer to Gillett, Arkansas was being conducted by the Memphis District, while the Little Rock District was to complete the remainder. In the area under the jurisdiction of the Memphis office, the plan called for the construction of about 47 miles of levee on the north bank of the Arkansas River at an estimated cost of approximately $1.4 million. Legal entanglements delayed construction for several months, but by the middle of 1939 the project was well underway.[21]

In 1939, General Harley B. Ferguson retired as president of the Mississippi River Commission. In May, 1939, he began a final inspection trip to drum up support for additional flood control work, and in particular, more cut-offs. He revealed that cut-offs and other river improvements would have made floods like that of 1927 nothing more than high water. Such a flood, he said, could now be carried below Vicksburg without reaching to within six feet of the top of the levee. His prediction of "no more floods" applied only to that part of the Mississippi River below the

Riprap being placed on bank as slopes are prepared.

Arkansas River. According to Ferguson, the 13 cut-offs had lowered the stages below Arkansas City from 13 to 15 feet,[22] but Ferguson's work on flood control, like his theories, was not accepted by all. At a testimonial dinner in his honor, Colonel Harry Jacobs, Chief Louisiana State Engineer, tried several times to get to the head of the table. Finally gaining the speaker's rostrum, Jacobs belittled Ferguson's work and criticized him for not giving more credit to the Louisiana State Engineers. Jacobs' comments became so vindictive that he had to be forcibly removed from the room.[23]

Though the Memphis District was carrying on a tremendous amount of work on the tributary streams, except for dredging very little work was being done on the Mississippi River. No new revetment or contraction works were constructed during fiscal 1939. The revetment work consisted only of repairs to previous work. However, late in the calendar year 1939, a mile-long willow mattress was placed at Oldtown Bend, Arkansas, to protect a levee threatened by caving banks. A similar project had just been finished at Avenue Landing, Arkansas.[24] Within the Memphis District, levee construction on the Mississippi and its tributaries amounted to only 16.6 million cubic yards. The small amount of work can be attributed to the fact that the main stem levees were nearing completion and most of the tributary projects were still in the planning stage.

The well-maintained levee has taken on a new dimension of community service as well as protection. The levee road provides access to otherwise inaccessible areas although created solely for levee patrol and maintenance.

In 1939, the Mississippi River Commission instituted a new levee policy. Before 1939, the Commission had viewed any travel on the levees as dangerous because the weight would cause the levees to sink. The great flood fight of 1937 had been made much more difficult to conduct because of the inability to get materials to critical areas. As a result, in 1938, the Commission had rejected its old policy of no roads on the levees and passed a resolution directing the district engineers to begin the construction of gravel roads on the levee crowns. The Memphis District had not yet initiated such as project in 1939, but the New Orleans District already had about 33 miles of gravel road constructed on the levees.[25]

In 1939, the Mississippi River fell to its lowest stage in 44 years. In October, the river dropped to -0.7 feet on the gage at Memphis. The lowest stage ever recorded prior to 1939 had been -2.7 feet back in 1895. Only two other times had the river decended to such stages – in 1872 the stage of -0.9 feet had been reached and, in 1894, the river had dropped to -1.4 feet.[26] All available dredging plants were pressed into service as fifty-six crossings had to be dredged in the Memphis District alone. Stages of the river were so low that it required both the loading of barges to a lighter draft and decreasing the size of tows handled.[27]

Low stages on the Mississippi River continued into 1940. In the middle of January the weather turned very cold and during the last 16 days of the month, the temperature dropped below freezing every day. Such extended periods of cold weather added to the low river stages created conditions favorable to the formation of ice gorges. Not since 1918, had the ice been as widespread on the Mississippi River. Navigation was halted for a 16 day period throughout the Memphis District from January 20th to February 5th. Before and after this 16 day period, ice gorges stopped navigation for another seven days. In the Memphis District, ice blocked navigation at Hickman, Kentucky; Gayoso Bend; Booths Point; Fulton, Tennessee; Richardson, Tennessee; Helena, Arkansas; and Oldtown Bend. During the last 11 days of January, ice covered 90 percent of the river in the Vicksburg District. Ice flows extended into the second New Orleans District and as far south as White Castle, Louisiana.[28]

The destructiveness of ice is evident here in this picture of Feb. 4, 1940. The Ice is in the bend of Island 30, looking downstream from Jacksonville Landing, Arkansas. Fortunately, ice seldom appears or forms on the Mississippi at such a southern latitude.

The Mississippi iced-over at Memphis, January 23, 1940.

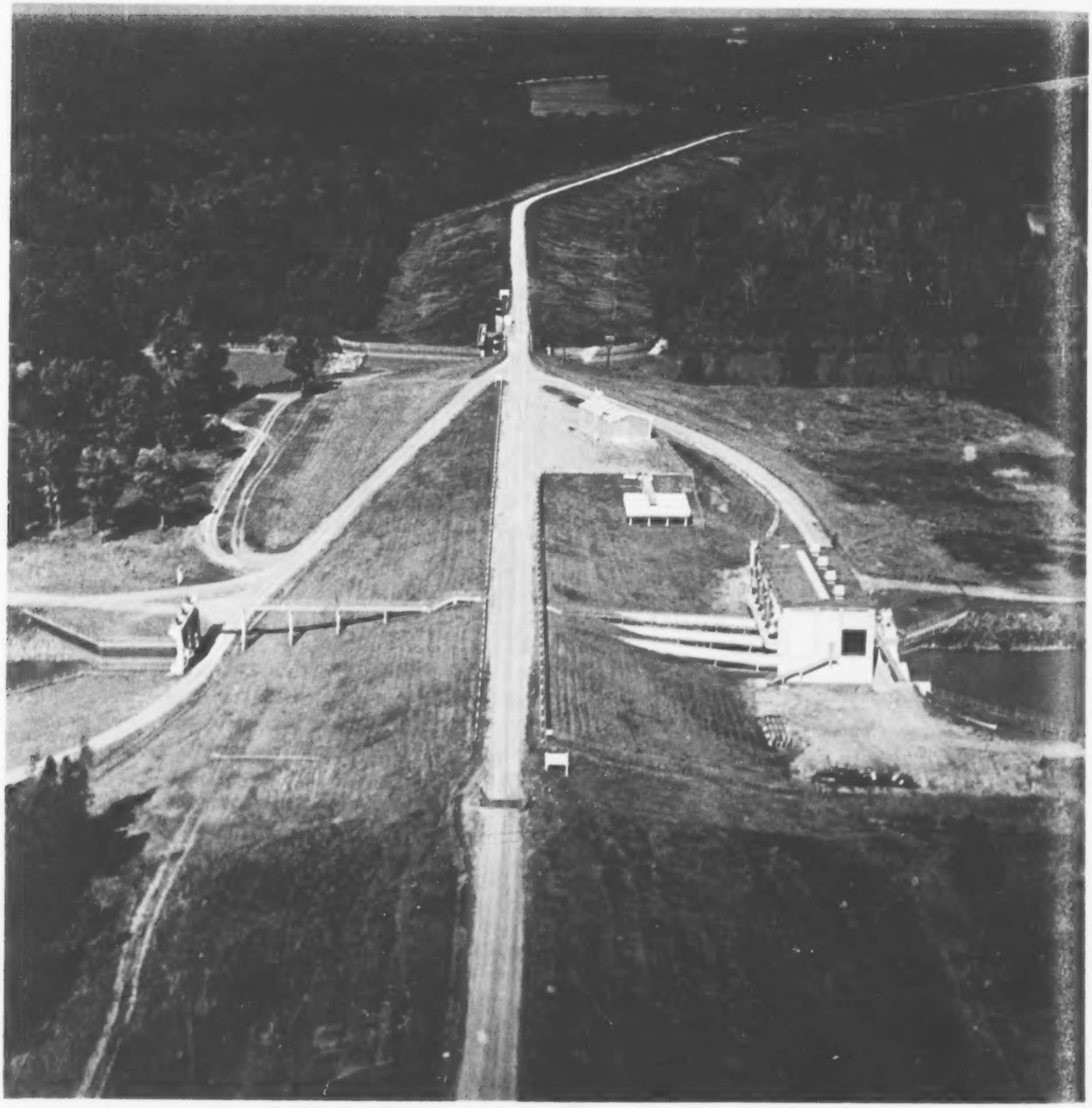
At the end of fiscal year 1940, the levees under the jurisdiction of the River Commission were more than 90 percent complete. Very few additions had been made to the main line levees because most of the Commission's energies were directed toward the tributary streams. The Memphis Engineer District placed just over 18 million cubic yards of dirt on the levees devoting about two-thirds of the total work to the tributary levees. Almost half of this total consisted of work on the White River backwater levee.[29]

During fiscal year 1940, more than $3.4 million was expended on the St. Francis River project. More than 3.4 million cubic yards of dirt was used in the construction of levees. Work on Wappapello Reservoir was pushed with vigor. By the end of 1939, the dam and reservoir was only about 17 percent complete, but at the end of fiscal 1940 the earthen dam was almost 60 percent complete.

In late 1940, the Memphis District invited bids on another section of the Memphis flood control project. Known as section four, the project consisted of a levee from Thomas Street to Payne Avenue and carried an estimated cost of $3 million.[30] The only other Memphis District construction of any consequence was devoted to the building of levee roads. By the end of fiscal 1940 more than 32 miles of dirt roads on the levees had been completed in the various levee districts under the jurisdiction of the Memphis office.

In 1940, President Roosevelt vetoed a river and harbor bill of $110 million in appropriations. In his veto message, the President stated that the War Department should devote its energies to military preparedness rather than nonmilitary activities.[31]

By 1941, the war in Europe had changed from a "phony war" into the real thing. Indications that the Corps of Engineers would devote more time to military activities came early in 1941. The Chief of Engineers asked for only $22 million for flood control in the fiscal year 1942 and Colonel J. D. Andrews, Memphis District Engineer, said work in the district would be curtailed. A further indication that the impending war would reduce flood control work came late in 1941. The Federal Government, through the Supply Priorities and Allocations Board, issued an order forbidding the start of any construction requiring materials needed for defense.[32]



The Graham Burke Pumping Plant, in Phillips County, Arkansas, landward of the White River Backwater Levee. Named for the late Judge J. Graham Burke of Helena, the plant serves approximately 145,500 acres of alluvial lands by removing water impounded between the White River Levee and the Mississippi River levee system. A considerable portion of the sump area is part of the White River National Wildlife Refuge. The Plant was completed in November, 1964.

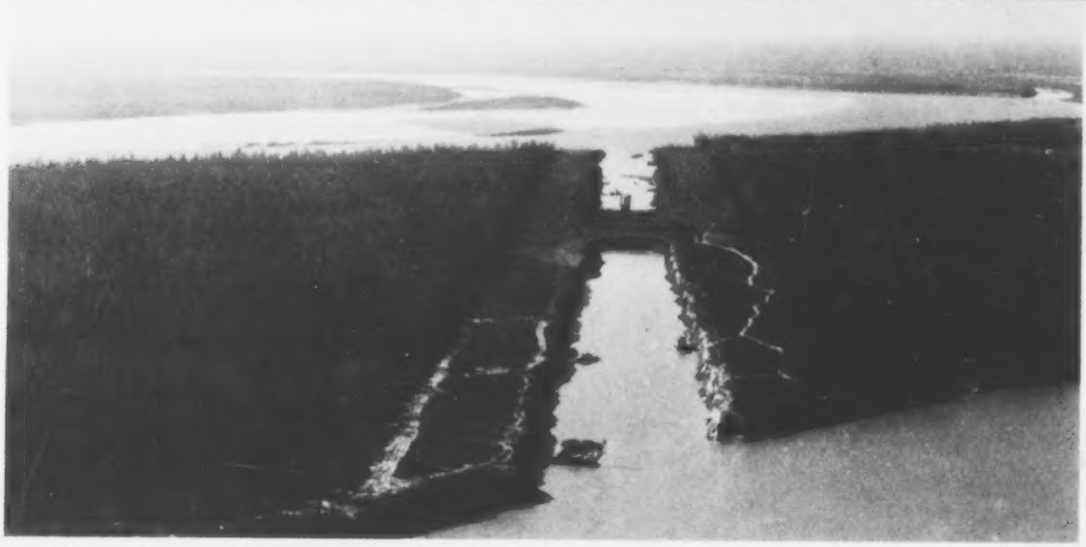
Even though the Federal Government was beginning to gear up for war, flood control legislation was still a paramount question. Ever since the Flood Control Act of 1928 became law, there had been strong opposition to some of its provisions. There was outright rebellion against the construction of Boeuf floodway and, continued opposition resulted in its abandonment. The Flood Control Act of 1936 had substituted the Eudora floodway in lieu of dropping Boeuf but this had failed to assuage the opposition, which believed the Eudora floodway, like Boeuf, was unnecessary. In early 1941, the River Commission submitted a report to Congress that recommended partially, or altogether, the abandonment of the Eudora floodway. The result was the Flood Control Act of August 18, 1941, which dropped the Eudora floodway in favor of higher levees.[33]

Two new flood control projects for the Memphis District were authorized by the Flood Control Act of 1941. The Augusta to Clarendon, Arkansas, levee project provided for the construction of approximately 40 miles of new levee and enlargement of existing levees in place on the east bank of the White River between Gregory Point and Clarendon, Arkansas. A protective levee for Georgetown on the west bank and a pumping station was also provided for. Estimated cost of construction was placed at $2.8 million. The second project involved flood protection for De Valls Bluff, Arkansas on the west bank of the White River. This work called for raising the existing levee three feet above the project flood, a floodgate structure, and three new drainage outlets.[34] Even though these two projects were now authorized, it would be several years before actual construction started.

Levee construction during 1941 amounted to approximately 17.7 million cubic yards. The Tiptonville to Obion River levee was completed except for clean-up operations. Work on the Memphis flood control project continued at a rapid pace. The Nonconnah pumping station was about 50 percent complete and the Nonconnah levee was complete except for two small gaps. The Cypress Creek pumping station was about 75 percent complete and the North Bellevue culvert had been finished. Plans and specifications for section two of the project were completed and contracts awarded and the levees in section four were under construction.[35]

Other levee construction resulted in the completion of an additional 19 miles of road on the levee crowns. More than two million cubic yards of material was added to the levees of the St. Francis project. Also in 1941, Wappapello Dam was 100 percent completed at a final cost of approximately $3.5 million.[36]

Bank protection work during the past several years had been devoted to repairs of old work. In Fiscal 1941, the Memphis District placed only 646 linear feet of new revetment while the River Commission itself only placed a total of 1.3 miles of new revetment.[37] Now that the United States was beginning to prepare for war, new bank protection work would be curtailed even more.



Aerial view of a cut-off nearing completion. The neck of land has been cleared of trees, and the channel has been cut to the point where only the plug remains. The plug will stay in place until river conditions are right for its removal.

There was no high water fight in 1941. Normally high water occurs annually between the months of January and June, but, in 1941, the high water stages were the lowest of record. At Memphis, the river never went above the 21 foot stage.[38] Such low stages had a detrimental effect on the dredging operations in the Memphis District.

In 1941, the Memphis District received permission to resume the cut-off program. Dredging on pilot cuts at Jackson Point and at Sunflower were started. Approximately 14 million cubic yards of material was removed in construction of the pilot cuts. Upon completion of dredging operations, an earth plug was left about the middle of each cut. The Engineers decided to wait for higher stages before blowing the fuse plug so that the cut-offs would develop at a faster pace. However, the current at Jackson Point was already eating away the plug. The Engineers tried desperately to save the plug, but it was washed out on April 26, 1941. Fortunately, fears that the cut-off would not develop were unfounded. Within a few days, the cut-off was carrying 20 percent of the river's total discharge. On April 29, 1941, the first towboat went downstream through the cut-off, and, about a month later, the first upstream .tow negotiated the cut-off.[39]

In late 1941, the United States entered World War II and the war emergency immediately affected the prosecution of flood control projects throughout the nation. Even though a major flood on the Mississippi would have caused as much damage as intensive air raids, the flood control program of the Corps of Engineers was revamped and co-ordinated with the war activities of the United States. Steps were taken to suspend all work not directly related to the war effort. No new projects would be initiated unless it was determined that the project would have a direct value to the war effort.[40] The wisdom of this policy was proven when the war was brought to the Mississippi River. In the spring of 1942, a German submarine made its way to the mouth of the Mississippi. The submarine sent three torpedoes into a merchant vessel and sent it to the bottom of the Gulf of Mexico with a loss of twenty-seven lives. The Germans boasted that their submarines were operating both in the St. Lawrence and Mississippi Rivers.[41]

Construction in the Memphis District began to drop off because of the shortage of supplies. Work on section three of the Memphis flood control project could not be started because of the shortage of concrete, which was needed for construction of the floodwall. Flood fighting on the Mississippi was also hindered. A major item in any flood fight was sandbags and, though no high water fight occurred in 1942, the Memphis Engineer District had to be prepared. A search for sandbags was made, but to their amazement none could be found. The war had cut-off the available supply of burlap from India, and American mills were making other necessary war materials.[42] It is said that the government actually engaged in the prolific planting of marijuana plants as a substitute for hemp.

Dirt was not critical in the war effort, so levee construction continued – but at a reduced rate. The machines necessary for levee construction were needed for the war effort. Only about 9.1 million cubic yards of levee construction were completed in the Memphis District. Section four of the Wolf River levee from Thomas Street to Maury Street was finished and plans and specifications for those sections not finished or started were completed. Just over three million cubic yards of material was added to the levees of the St. Francis River and they were now about 32 percent complete. Levees on the Little River, a part of the St. Francis project, were completed.[43] In addition to the levee work, more than 18 miles of road was constructed on the levees in Memphis Engineer District.

Bank protection work also suffered from the needs of war. Concrete was in short supply, therefore little bank protection work was done. In fact, no new revetment was placed in the Memphis District and over the entire Lower Mississippi only about 2.5 miles of bank protection was constructed.[44] By now, it was a well known fact that revetment

Sunflower cut-off channel complete except for the emoval of the plug. December 26, 1940.

The Sunflower cut-off plug was removed on February 16, 1942, with a 1600 pound dynamite charge.

Sunflower cut-off, immediately after the plug was blasted. Note the increase in the width of the crevasse and the turbulence below.

played an important part in flood control and keeping a navigable channel open. The Flood Control Act of 1928 had invisioned a major revetment program, but wartime limitations of funds retarded the project. Revetment as a means of training the channel was desirable, but – to be of help – revetment had to be placed before the banks began to cave. Lack of funds required that the River Commission place revetment where it was most needed – to protect a town, levee or other valuable property.

In 1942, the cut-off program of the Mississippi River Commission came to an end, but the desire for more cut-offs would continue. Two additional cut-offs were opened in 1942 – both in the Memphis District. The pilot cut of Sunflower Cut-Off had been completed in 1941, but the fuse plug was not removed because of low river stages. On February 16, 1942, the plug was blown. Development of the cut-off was slow at first, but, by June, the cut-off was carrying 50 percent of the total discharge of the river. A pilot cut requiring the removal of approximately three million cubic yards of material from a mile-long section resulted in Hardin Cut-Off. On March 18, 1942, a ton of dynamite blasted the plug out of the Hardin Point Cut-Off, a mile long channel that eliminated a horseshoe bend approximately 15 miles long. This particular cut-off was unusually spectacular, in that it developed so rapidly witnesses observed a nine foot wall of water pushing through the new channel, and river traffic was delayed for a week.[45] With the Hardin Cut-Off, the Memphis Engineer District had constructed the final cut-off on the Lower Mississippi.[46]

Cut-offs have had a credit and debit aspect since the program ended. The program decreased the length of the river and improved channel alignment while saving many miles of revetment by eliminating river bends. Flood stages were reduced because of the increased channel capacity. But caving banks above each cut-off can be placed on the debit side of the ledger as a great deal of revetment was destroyed by such caving. One other aspect of the cut-off program is hard to determine. Large amounts of revetment in the bends that were cut-off were lost, but on the credit side, repairs to these revetments were no longer a problem.

As to be expected, the opening of a cut-off channel brought changes in river currents, accompanied by an increased velocity. River pilots and captains were often apprehensive about these changes, but no major problems developed. Whenever any severe changes were anticipated, river traffic was delayed and other towboats were brought to the vicinity to aid any tows that needed help. All captains, however, disdained this aid as a reflection upon their own competence. Only once did a minor problem develop. When the Jackson-Sunflower cut-off was opened, one embarrassed captain found his tow caught in cross current, then completely turned around and started on its way back downstream. The situation was quickly rectified, and he proceeded upriver without further problem, asking only that his incident not be given personal publicity.[47]

When additional cut-offs on the Mississippi will be needed is hard to determine. The River Commission has pushed for more cut-offs at several locations, but general opposition has prevented their construction.

Work on the Mississippi River and Tributaries Project was further curtailed in 1943. In the past, the War Production Board had decided which projects would have preference. Projects with a preference rating were those judged important to the war effort and several of the flood control projects on the Lower Mississippi had already received this status. Because of the ever expanding war effort, the War Production Board in 1943 revoked the preferential rating of a number of Lower Mississippi projects. A need to conserve materials and equipment judged necessary for war was given as the justification for revocation.[48] Among the flood control projects affected by the order were six sections of the Memphis flood control project for Wolf River and Nonconnah Creek. Also, because of the war, the Mississippi River Commission decided to forsake one of its more pleasurable duties. The Commission decided that its spring inspection trip was inadvisable and, that individual inspections could be made when the members of the Commission thought it necessary.[49]

Because navigation of the Mississippi was even more important in wartime than in peacetime, the mission of the District did not undergo any radical change as a result of the war. The emphasis continued to be placed on the Mississippi, but other war-related endeavors were undertaken, bringing some new problems for the District. One necessary expedient was to commission some of the key civilian personnel so that they would not be drafted and thus removed from the critical task of keeping the Mississippi open. Among the first individuals to be given this protection through a commission was the personable Guy Hurley. Hurley, who had been with the District since his freshman year in college, had no military background but he did know his work, thus he was given a commission as First Lieutenant. This came shortly after the arrival of a new District Engineer, Col. Jarvis J. Bain, the senior ranking colonel in the entire U.S. Army. Col. Bain made no distinction between a regular army Lieutenant and an impressed civilian-Lieutenant, so one might have expected some conflict in philosophies. Hurley was content, and intent on carrying on in his usual competent but free-lance style, while the Colonel expected rigid military conformity. Especially unappreciated was Hurley's sense of humor. When Hurley learned that the Colonel demanded large signs everywhere, and for all functions, he incurred the Colonel's wrath by placing a sign at the end of a flying school runway, the sign noting "South End." Still more unpardonable was Hurley's penchant for going where he thought he could be most helpful. As part of the war effort the District had been told to supervise the construction of a flying school at Walnut

Guy Hurley at his World War II post, showing no stress.

Ridge, Arkansas, but the District was also to investigate the possibilities of another flying school at Halls, Tennessee. The Colonel had assigned Lt. Hurley to the Walnut Ridge project, but at one point Hurley concluded that he had done everything that there was to be done at the moment, so exercising his customary initiative Lt. Hurley left Walnut Ridge to go investigate the site at Halls. When Colonel Bain was later appraised of this show of initiative he not only went into a rage, he ordered a court martial for Hurley. Fortunately for Hurley, when an investigating officer arrived he came to the immediate and accurate conclusion that Hurley knew nothing of Army protocol, and was only performing his duties as he had customarily performed them. The charges were dropped, but the wounds weren't healed. Wisely, Hurley decided to accept an opportunity to transfer to General Noce's staff in Washington. General Noce, the same who had formerly been Memphis District Engineer had already recruited Jimmy Smith out of the District, and Smith had suggested that Hurley be brought up also. Hurley did return to the District to resume his civilian carrer in 1946, where he would stay until his retirement in 1971. Hurley's enthusiasm, competence and efficiency served the District well, and he advanced to Assistant Chief of Operations in 1950, then to Chief of the Operations Division, wherein he controlled those five branches of the division which performed the functions of care and operation of floating and land plant facilities, channel maintenance and navigation; operation of flood control structures, and the placement of revetment. In a citation presented at the time of his retirement, it was noted that "few men have had such an impact on the development of the Mississippi River."[50]

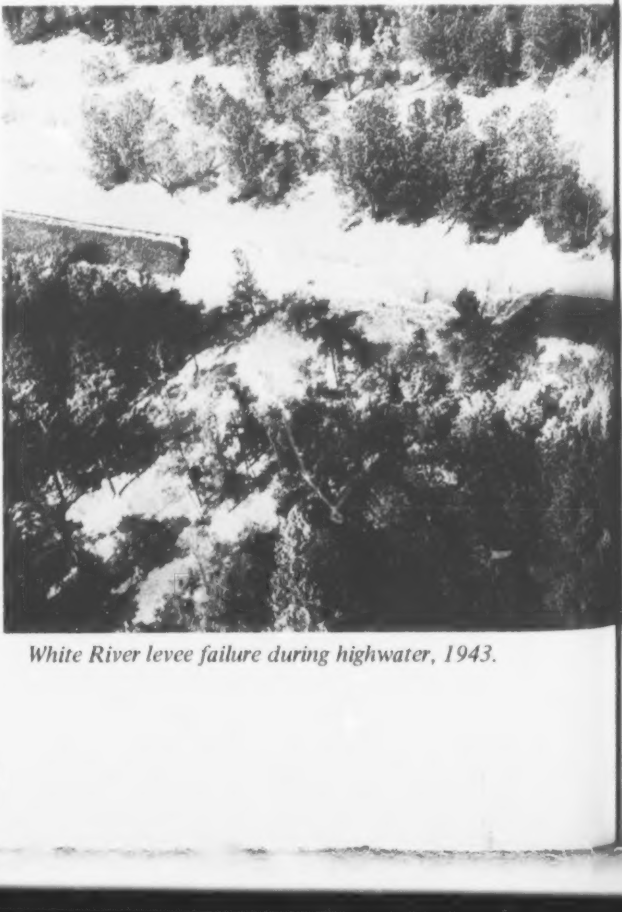
World War II also created some memorable experiences for another well-known and thoroughly liked individual, Joe Overall. As one of the most experienced and competent pilots working the Mississippi, Joe was called upon as the man who might get seventy-eight steam army tugs, with 16 ft. drafts, down a River dredged to little more than half that depth in some spots. The Pittsburgh builder had contracted the transportation job, but the original contractor had found himself with a seemingly impossible task, made all the more impossible when he had tried to double his profits by lashing the tugs together in pairs. Joe met the contractor at Cairo and took over the task of delivering the tugs to New Orleans. His approach was both practical and adventurous. He lightened each tug by reducing the fuel load to minimum, thus reducing their draft to about 13 feet. As the tugs proceeded downstream, Overall did not approach the shallow "crossings" with caution and trepidation, as had the previous contractor, but instead he approached the bars with open throttle and actually grounded the tugs. His theory, which worked out beautifully, was that the following swell would slam into the rear of the tug and shove it across with its lift and thrust. Every tug was delivered, to the relief of the army and the appreciation of the contractor.

Overall also remembered the unique experience of piloting a submarine down the Mississippi, and the frustrating experience of trying to direct a helmsman who was not only distant from him, but totally dependent upon oral instructions. The sub nearly speared Australia Point (near Sessions, Mississippi), until Joe shouted a few expletives that brought the sub about so smartly that the conning tower leaned far out over the water.

Joe Overall at the wheel of the "Coiner." Before his retirement, Overall gained the distinction of piloting some most unusual craft on the Mississippi, from submarines to Panama Canal gate.

It was not the submarine that Overall remembers as the most unusual craft that he ever piloted down the Mississippi. That distinction attaches itself to a locking gate destined for the Panama Canal. Fabricated in Pittsburg as a replacement for one of the existing gates in the Zone, the gate presented a gigantic problem. Even while resting on its side the gate was 65 feet high, and the weight was such that it would have required special barges. When consulted on the navigation problem Joe suggested that it would be folly to attempt to barge such an object through the shallow crossings and under the bridges, but he offered an alternative approach. Since the gate was of honeycomb construction, and water tight, why not weld towing rings to the gate and simply tow it to its destination? The plan was adopted, and Joe "piloted" the gate to New Orleans, using one of the gun turrents as a pilot house. Overall remembers the experience vividly, not only because of the uniqueness of the "vessel," also because he was higher above the Mississippi than he had ever been before, and from that height everything looked so unaccustomedly strange.[51]

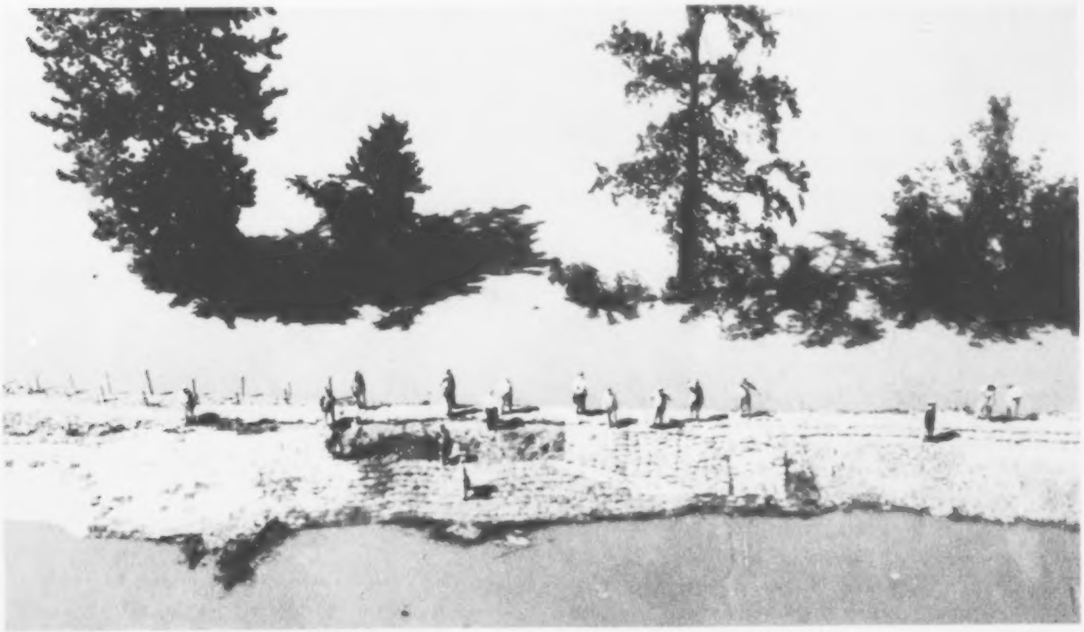
The amount of construction in the Memphis District reflected the war-first attitude of government officials. Before the war the Memphis Engineer District had often placed as much as 30 million cubic yards of material on the levees. Revetment work had been so extensive that – in reporting the construction – the Memphis office had used "miles constructed" instead of "feet constructed." No new revetment was constructed in 1943 – concrete being judged critical to the war effort, and bank protection work was limited to repairs to old revetment. The same condition existed in levee construction. Additional material placed on the levees amounted to approximately 6.9 million cubic yards.[52] About the only type of work that was increased was in levee road construction. During fiscal year 1943, the Memphis District completed a little over 34 miles of new roads on the levees. Since the road construction program had started, Memphis Engineer District had constructed only a total of 105 miles of roads on the levees,[53] a total mileage that appears small when you consider that more than a 1,000 miles of levee was embraced by the Memphis District. However, those roads which were finished proved to be of great value during the high water fight of 1943.



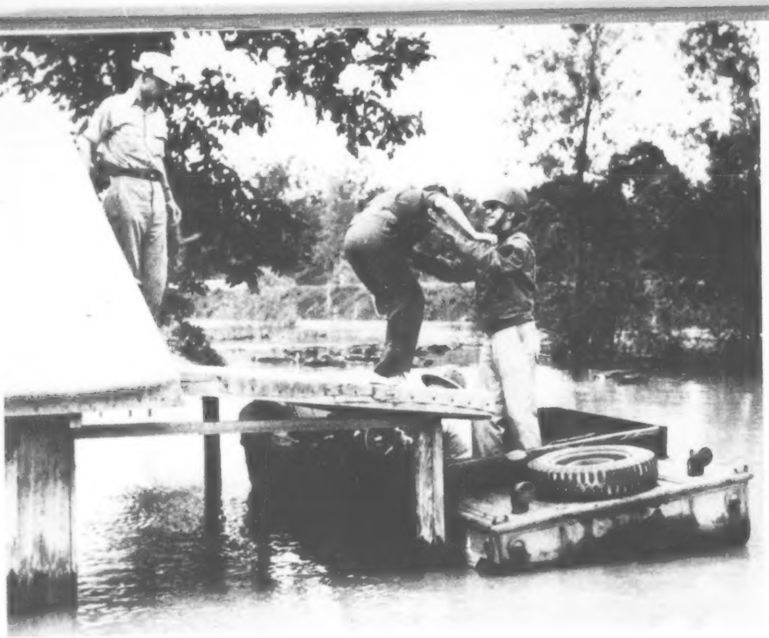
White River levee failure during highwater, 1943.

In May, 1943, heavy rains fell over the Arkansas, White, Missouri, and upper Mississippi River Basin. Stages on the upper Mississippi were exceeded only by those of 1844. Near St. Genevieve, Missouri, there were 15 crevasses in the levee. A shortage of flood fighters resulted in the heavy use of enlisted personnel, but also there was extensive use of German war prisoners on a voluntary basis. The war prisoners did an admirable job, saving many thousands of acres from being inundated. Prisoners were paid eight cents for an eight-hour day plus a sum equivalent to their army pay.[54] Before the floods reached Memphis, the waters had already taken the lives of 21 people.

At Memphis, the river stage was not exteme – never going above the 39 foot stage. Main line levees were in no danger, but several private levees gave way. In 1943, the Mississippi River Commission used engineer troops in fighting a flood for the first time. On the Obion River, approximately 1,000 troops were used in trying to hold a road embankment that served as a levee.The valiant effort was to no avail and the embankment gave way, but – because of the fight by the troops – the residents had ample warning that the levee might break. Once the levee had given way, the engineer troops assisted in evacuating the people from the flooded area.[55]



Men at work adding height and protecting the slope of an emergency levee at Booth's Point. May 29, 1943.



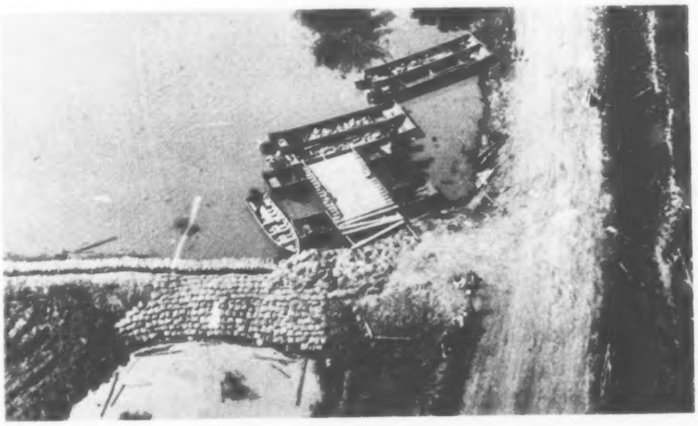
The White River flood of 1943 created a natural condition for the 75th Engineer Light Pontoon Company to assist in rescue operations. Here a woman, stranded on top of her inundated house, is assisted into an amphibian vehicle.

There were no crevasses of the levees on the tributary streams in the Memphis District, though record stages were exceeded at some locations. Approximately 4,500 engineer troops were used in the high water fight. The District Engineer was commander of these troops. The troops raised levees, filled and placed sandbags, transported material, and worked at all other phases of flood fighting. Without their help, there might have been extensive flooding and, even with it the District Engineer reported that more than 1.2 million acres had been overflowed in the Memphis District.[56]

Prisoners of war were used in another capacity from 1943 to the end of the war. At Clinton, Mississippi, they constructed a model of the Mississippi River and its tributaries. Surplus army equipment was used so as to not retard the war effort and, for many months, the only tools were shovels and wheelbarrows. The model required about 220 acres of land. It was built to scale with one foot representing 100 feet vertically; the total length of the model streams was approximately eight miles. The model was designed to be completed in sections so that the completed portions could be used in studies of the river.

Finished in the late 1940's, the model was used to solve many problems related to river and flood control work. In 1970, the Engineers were caught in a budget squeeze and declared the model surplus. Officials of

Emergency dock construction as used during floodwater. Filled sacks are trucked to dock, loaded into pontons, then taken to endangered sites. Note also sandbag plug in levee breach. May 29, 1943, Booth's Point.



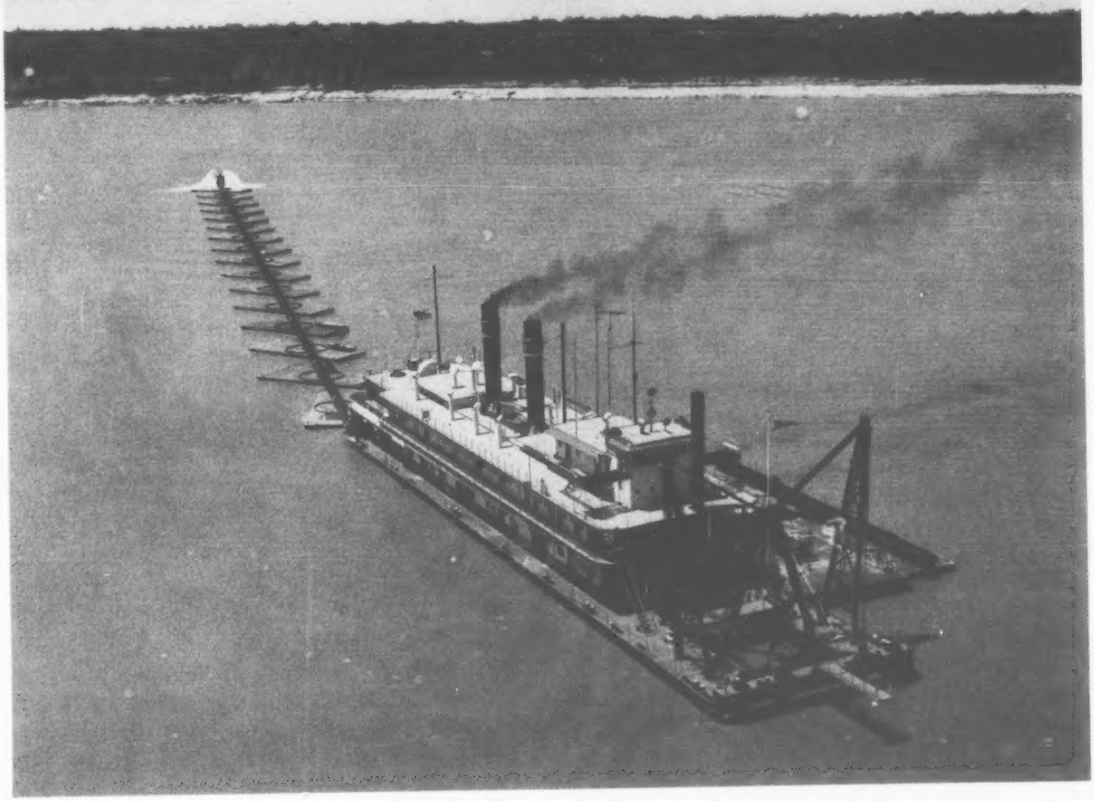
the office of Chief of Engineers declared that the model had already provided all the information the Engineers needed on the Mississippi River Basin. The information had been stored in computers and could be recalled at any time. The Engineers turned the model over to the city of Jackson, Mississippi, to be used as a park. When General Charles C. Noble assumed the presidency of the River Commission, he started negotiating with the city to obtain a long-term lease to use the model. General Noble had opposed the abandonment of the model, and his position was emphatically sustained during the great flood of 1973. At that time the waters were running higher than ever before, thus the computer could not have been fed such information. The General obtained special permission to use the model for a flood profile, and the information obtained was of great value in fighting the flood. The Corps is still seeking to obtain a permanent lease on the model, but no such arrangement has been concluded as of this writing.[57]

In March, 1943, the House Flood Committee and Senate Committee on Commerce passed a resolution calling on the Chief of Engineers and the River Commission to submit a report on the feasibility of amending the navigation provisions of the 1928 Act, with specific reference to increasing channel depths from nine to twelve feet, from Cairo to Baton Rouge. On February 14, 1944, the Commission tendered its report.[58] The report indicated that the Flood Control Act of 1928 had invisioned the stabilization of the banks in the interest of flood control and navigation. Revetment, dikes, and the cut-off program had combined to produce a relatively stable channel. It was the opinion of the Commission that the channel had to be preserved in its existing position in the interest of flood control and navigation, but that an extensive stabilization program was needed to maintain it. The Commission felt that such a stabilization program with dredging might be enough to provide a 12 foot deep channel. It was thus recommended that the 1928 Act be modified to include a 12 foot channel between Cairo and Baton Rouge.

Two good arguments made the project acceptable to members of Congress. First, the increased channel depths would allow heavier tows and increase commerce on the river. Secondly, a project of such magnitude would ameliorate the expected unemployment that would follow the end of the war. The act, if approved, would not endanger the war effort because it was only an authorization bill and no appropriations would accompany its enactment. The fact that it was only an authorization act was the key feature that made it inoffensive.

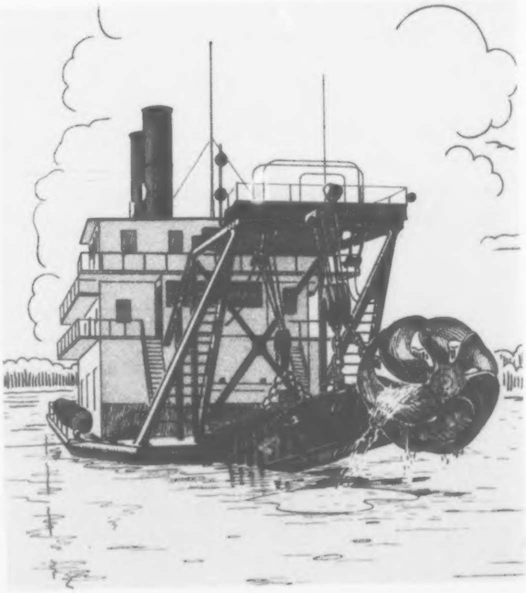
After almost a year of debate, on December 22nd, the Flood Control Act of 1944 became law. It authorized approximately 150 additional projects throughout the nation at a cost of $750 million. The act authorized a channel depth of 12 feet in the Mississippi River between Cairo and Baton Rouge and a $200 million stabilization program. Approximately 600 miles of revetment and 100 miles of dikes would be needed plus about 175 months of dredging to accomplish the project.[59] Even after the first funds became available, it would be decades before the project could be completed.

In 1944, work was expanded on various flood control and navigation projects in the Memphis District. However, the Memphis flood control project received the lowest priority and thus little was accomplished. Levee work had been decreasing for several



"Ockerson" at work dredging channel.

A frontal view of the cutterhead dredge, with cutter in transport position. The number of blades on the cutterhead may vary from three to six, as illustrated here. The cutterhead dredge is designed to cut through material which is too compact to be handled by the dustpan dredge, and is thus used principally for changing the alignment of the channel or for harbor channel work.



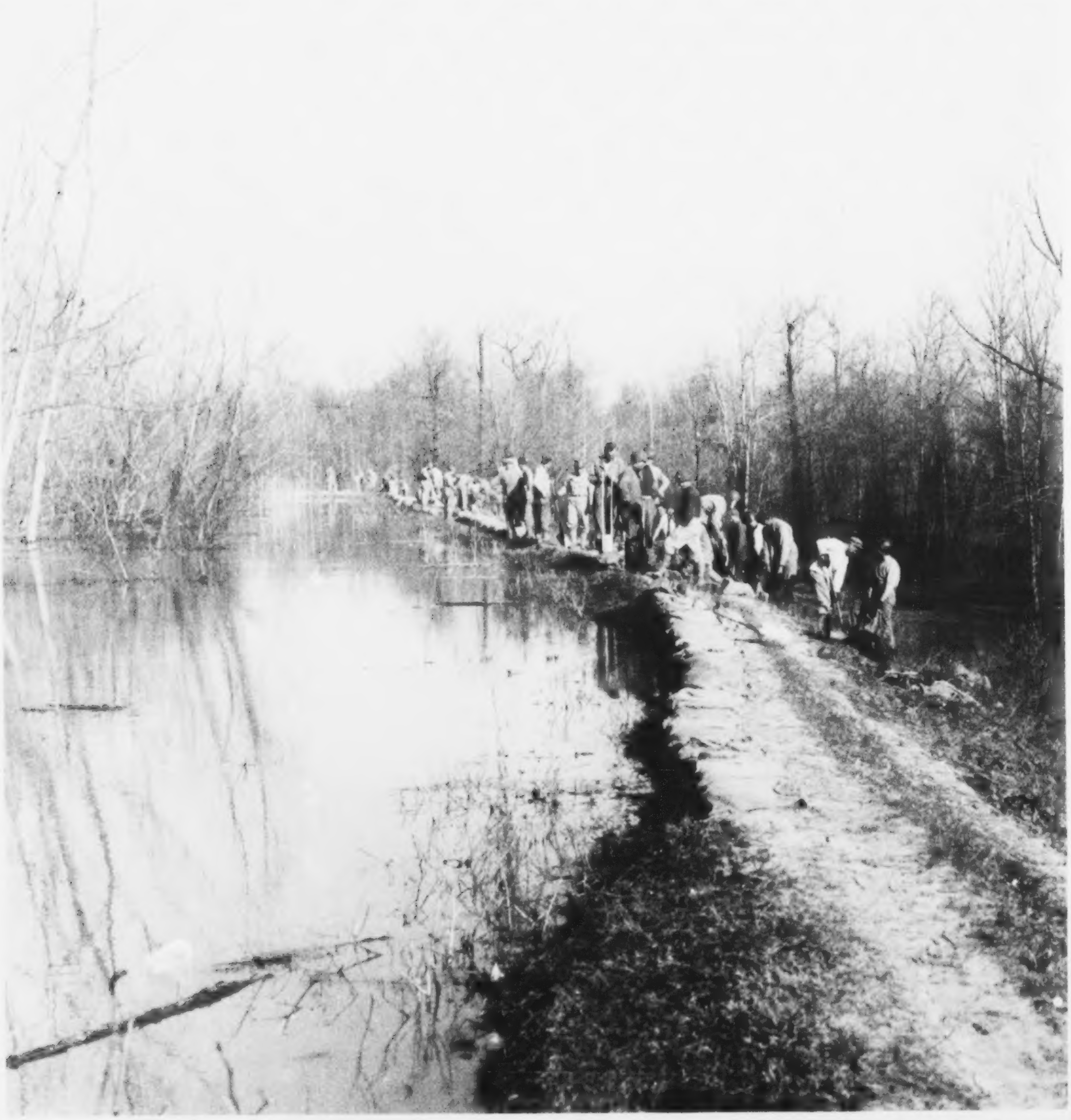
years, but, in 1944, more dirt – approximately ten million cubic yards – was placed on the levees than in several of the previous years. Much of the increased levee work can be attributed to damages created by the high water of 1943. Dredging operations were about normal for the low water season and bank protection work was given impetus by expanding appropriations. For the first time in several years, the Memphis District undertook the construction of new revetment. More than 17,000 linear feet of new bank protection was placed at six locations and about 7,000 linear feet of extensions to old revetment were constructed.[60]

Civil works by the Corps of Engineers began to increase in 1945, even before the end of World War II. Most of the work was devoted to surveying and planning projects that could be undertaken when the war did end. Public hearings were held to determine if new flood control projects were needed and, because of the recent authorization for a 12 foot channel in the Mississippi, navigation and harbor facilities were among the chief topics.

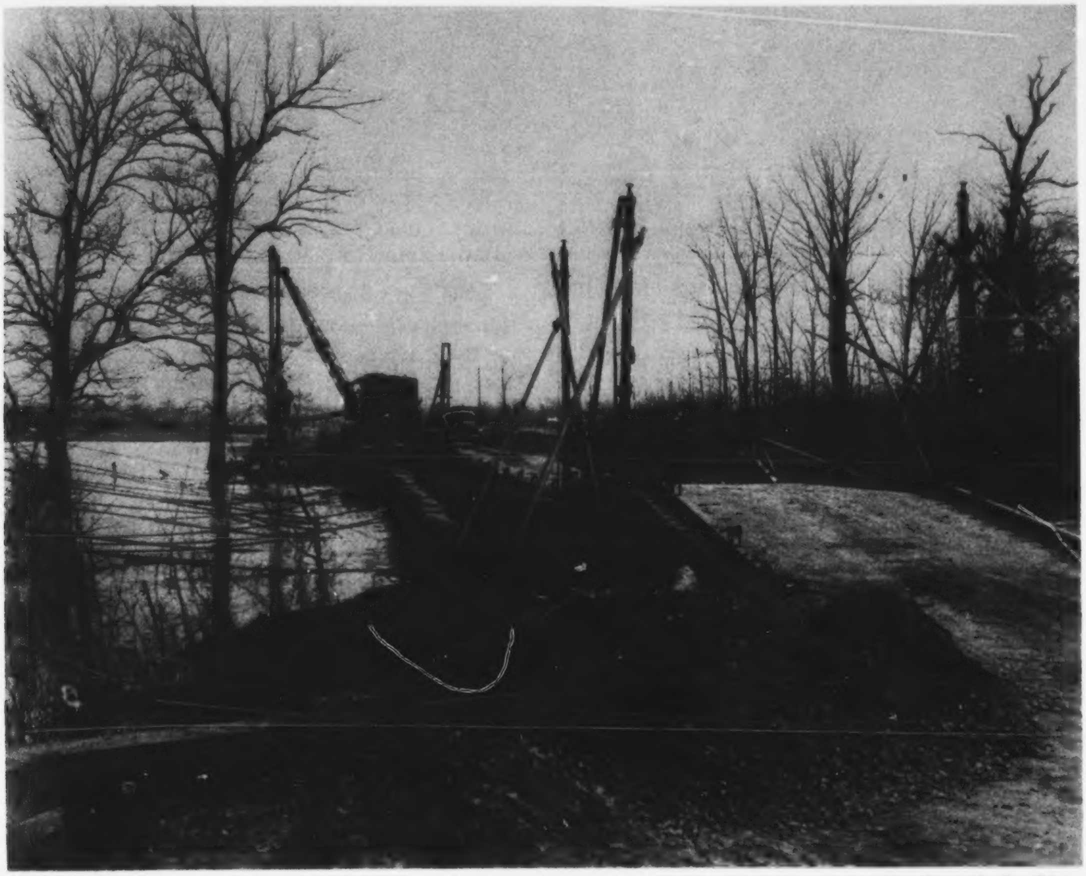
The ending of World War II did not increase construction work to any significant degree. New revetment amounted to approximately 21,000 linear feet of new bank protection and extensions of old work.[61] Levee construction consisted of placing nearly ten million cubic yards of material on the levees. The levees under jurisdiction of the Memphis office were now 86 percent complete.[62]

The Memphis Engineer District in 1945 conducted the most extensive high water fight since 1937. Winter rains had dumped as much as 13 inches on many places during the last month of 1944 and moderate to heavy rains fell over the Ohio and Tennessee River Basins in late February, 1945. By March, additional precipitation over all of the basins drained by the Mississippi River sent the river out of its banks.[63] Subsequent rains made it evident that a major high water fight would be necessary. On March 1st, the flood fighting plan of the Memphis District was placed in operation. Within two days, mobilization of the personnel, supplies, and equipment necessary for opening the Birds Point - New Madrid Floodway was completed and the equipment placed on a stand-by basis. On March 6, the District Engineer awarded an emergency contract for the raising of the floodwalls at Cairo, Hickman, and Caruthersville. Under terms of the contract, the walls were to be raised four feet within ten days.

Cairo, Illinois, surrounded by floodwaters of 1945.



During the White River Flood of 1945 troops of Co. A, 205th Engineer Combat Battalion, worked under great pressure to save the Jackson Bayou Levee, opposite Weeks Landing, Arkansas. Almost half of the levee had already sloughed away, but the troops were successful.



Temporary pontoon bridge placed by the 516th Engineer Light Pontoon Company, to replace Cache River bridge lost in the Flood of 1945.

For the third consecutive year, regular engineer troops were called on to help fight a flood. The first major trouble developed on the White River. About 2,000 troops were sent to the area when a sudden rise in the river sent the water within three inches of the top of the levees on the west bank. As one group of about 30 troops were making their way to a threatened area, the assault boat carrying the troops capsized in the cold waters of White River between Des arc and De Valls Bluff. Fortunately, all but one of the troops were rescued after clinging to trees and other objects for several hours.[64]

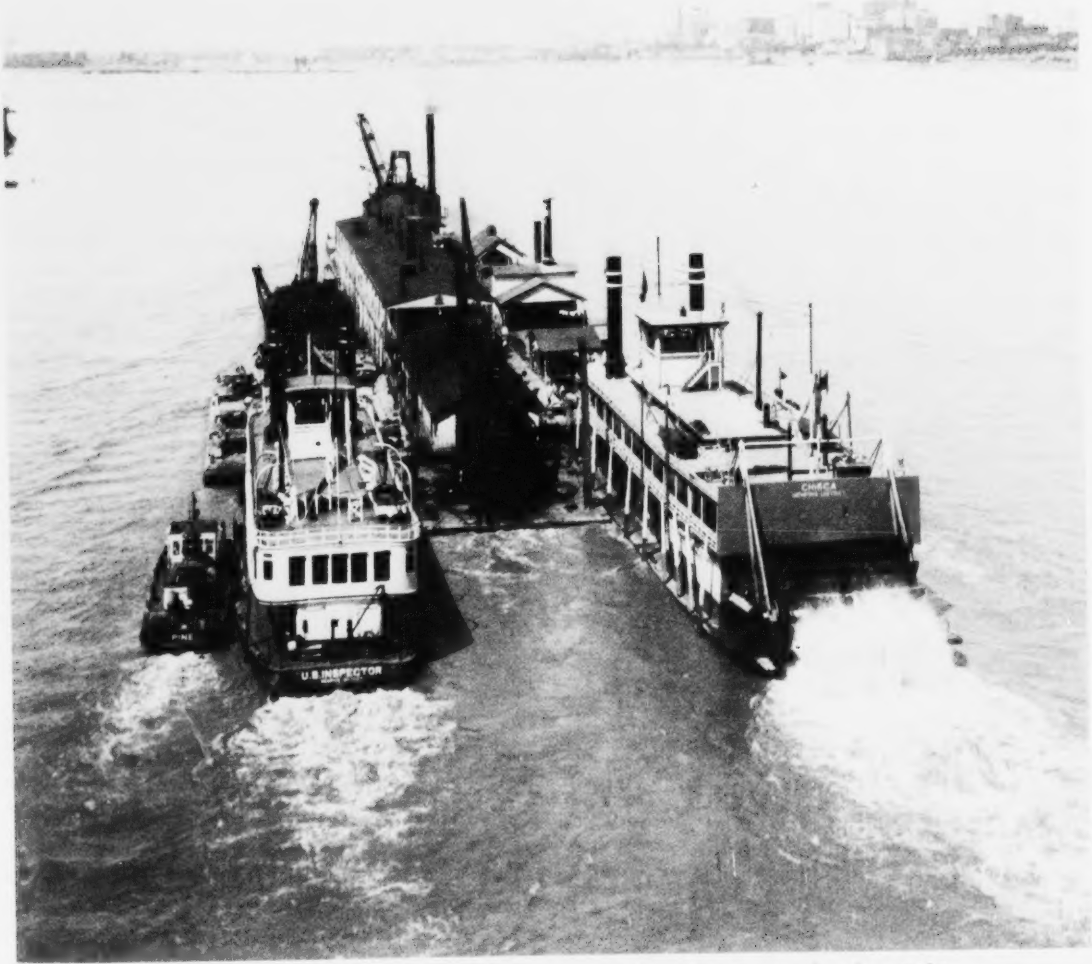
Engineer troops and local officials joined forces in a determined effort to save the levees holding back White River. They were successful at most places, but, on the night of March 13th, at least seven crevasses occurred in the levees of Woodruff, Prairie and Monroe Counties. Inhabitants of the area had been warned of the danger, therefore, no lives were lost, but about 45,000 acres were flooded in addition to the acreage already flooded by backwater.[65]

Flooding on the St. Francis River in Arkansas presented a unique problem for the Engineers. Wappapello Dam and Reservoir had been constructed in order to regulate the discharge into the river below and a gradual release of the water in the reservoir would keep the pressure off the levees below. However, heavy rains caused the Engineers to warn the local levee districts that a major flood was probable. The reason for this warning was that the outflow of the reservoir could not be raised to the maximum because the local levee districts had not provided rights-of-way, thus it was feared that the flows would overtop the levees. By April 16th, a wall of water three to six feet in depth was cascading over the top of the spillway.[66] It was quickly evident that the levees could not hold the flood without crevassing and several small crevasses soon occurred after the water began to go over the spillway. About 20,000 acres were flooded.

In West Tennessee, the Engineers waged a determined battle to hold several private levees. On March 10th, a private levee in Dyer County crevassed after efforts to sandbag the levee failed and an estimated 10,000 acres of farmland was inundated. As a result of this break, it was decided that a more determined fight was necessary. About 150 Tennessee State convicts were put to work fighting the flood. Engineer troops, local laborers, and convicts were sent to the Booths Point - Tennemo area where a road embankment, which served as a levee, was about to give way to the pressure of the water. Floodfighters worked desperately to save the levee, but a 300 foot crevasse was blown out by the water. This crevasse resulted in the inundation of approximately 30,000 acres.[67]

The flood on the Mississippi was carried through the Memphis District without a break in the government levees. Because of the slow rise of the river, the engineers were able to deploy manpower and supplies to critical areas before the situation got beyond their control. A crest stage of 40.45 feet on the Beale Street gage was reached on April 5th, but it had taken about a month to reach this crest after passing the flood stage. Within two more weeks, the Mississippi River was back within her banks.[68] The personnel at the Birds Point - New Madrid Floodway was retained from March 3rd to April 30th and then — to the relief of local landowners — discharged without placing the floodway in operation.

A fine example of an emergency bridge, constructed by the 129th Engineer Combat Battalion, to act as a temporary replacement for the Highway 38 bridge over the Cache River, near Cotton Plant Arkansas. White River Flood of 1945.


U.S. INSPECTOR

Bank Protection Party No. 12 moving upriver to Island No. 8 to undertake repairs.

CHAPTER IX

The Old War, the Cold War, and the River: 1946-1959

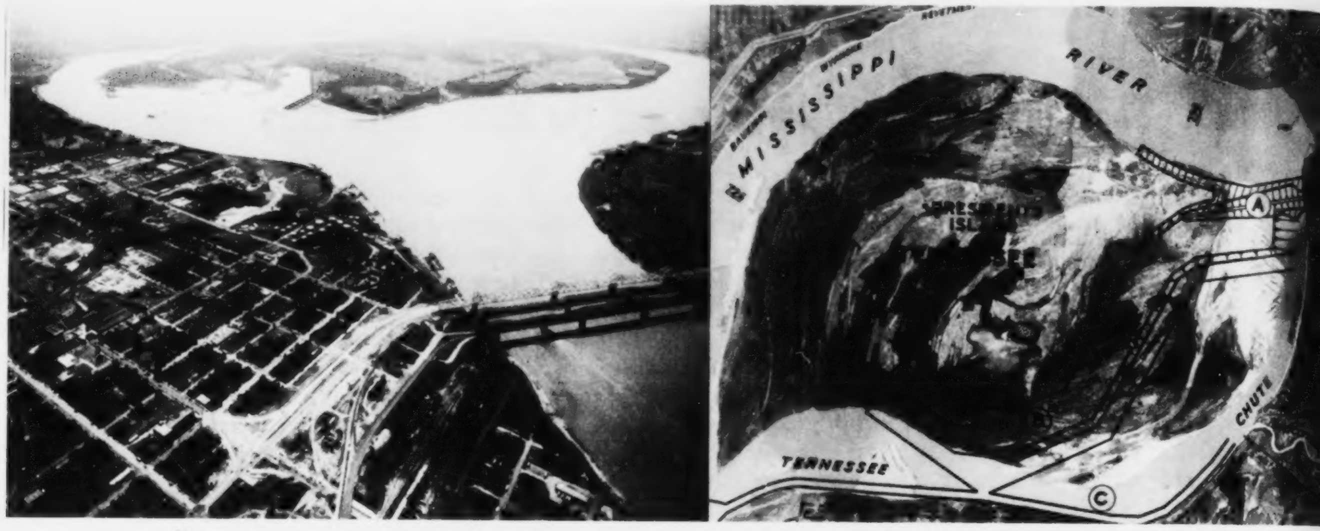
With the end of World War II, the supporters of flood control in the Lower Mississippi Valley were hopeful that work on the suspended portions of the project could be renewed. The flood of 1945 had given convincing evidence that the projects had been neglected for far too long. Several projects had been authorized during the war, but no funds had been appropriated to initiate construction, and many previous by-constructed projects were badly in need of repair. According to flood control advocates, it was time to get on with the job of controlling the Mississippi River and its tributaries.

Mississippi River Commission, April 1946.

As soon as Congress returned to work in 1946, the Public Works committees presented a combined flood control and rivers and harbors bill. But President Truman was able to play both sides of public opinion. On the one hand he signed the large Flood Control Act, but on the other hand he maintained the confidence of the economists by refusing to sign the bill to provide funding. Authorized in the Flood Control Act of 1946, were approximately 110 new projects throughout the nation, at a projected cost of $611 million, plus an additional expenditure of about $100 million for improvements on the Mississippi River and its Tributaries. In the Memphis District, the authorization act provided for extension of the Tiptonville-Obion River levee and the improvement of St. Johns Bayou in Southeast Missouri, as well as providing flood protection for DeValls Bluff, Arkansas. The most important part of the Flood Control Act of 1946, as it affected the Memphis District, was a provision for additional harbor facilities at Memphis.[1]

When Colonel Garner W. Miller, Memphis District Engineer, had conducted public hearings, concerned citizens of Memphis expressed a need for additional harbor facilities for industrial development. At one meeting, local officials had even suggested that the lower four miles of Loosahatchie River be developed. In response, the Senate Commerce Committee authorized the Mississippi River Commission to make an examination and to report on the development of Tennessee Chute area as a harbor facility.[2]

Memphis had thirty-six terminals, but river commerce was on the increase. River tonnage at Memphis had increased from less than one-half million tons in 1922 to two million tons in 1946. In addition to the Wolf River sector, Memphis harbor had several terminals along the riverfront south of Mud Island to the head of Tennessee Chute. Unfortunately,



This sequence of pictures depicts some selected stages in the construction of Memphis Harbor. As the first picture shows, President's Isle was truly an island, with the main channel of the Mississippi dividing at the upper end and reconverging at the lower end. Picture No. 2 shows the intended plan, that of cutting off the fast developing Tennessee Chute, and creating a secure port in the slackwater area.

none of the available riverfront was suitable for a heavy industrial port development. In February, 1946, the District Engineer held another public hearing with a view to expanding existing harbor facilities. Most of the testimony centered on the "Tyler plan" as developed by General M. C. Tyler, President of the Mississippi River Commission: Just south of the Mississippi railroad bridges at Memphis, the river wheels to the west around Presidents Island. Along the eastern shore of the Island Tennessee Chute flowed south-southwest to re-enter the river at Mile 722. The Tyler plan contemplated closing off Tennessee Chute on the north, and to use the slack water chute as a harbor facility. The harbor would be accessible through its channel to the south of Presidents Island. By the provisions of the Flood Control Act of 1946, the Tyler plan was adopted with an estimated cost of more than $17 million.[3]

Construction of the project was not initiated until 1948. The main features of the project were a dam, approach to the dam, industrial fill, pumping station, and a levee. A dam to close off Tennessee Chute was constructed. The earth dam was 6,800 feet long at the crest and contained approximately six million cubic yards of material. An approach to the closure dam 2,300 feet long was constructed to provide highway and railroad access to the industrial fill. Approximately forty-eight million cubic yards of material was placed on the industrial fill and raised 960 acres above the project flood. A channel of twelve feet in depth and 300 feet wide was dredged in Tennessee Chute. A levee and a pumping station gave protection to an additional 6,800 acres in the Pidgeon Industrial area. The Memphis Harbor Project, with all of its salient features, was not completed until 1967.[4]

Pictures three and four depict representative stages in the development. Of historic interest is the fact that the last willow mattress was constructed as part of the effort to stabilize the revetment sealing off the Tennessee Chute, and its site is distinguished today by a stand of mature willows.

On August 2, 1946, Truman impounded flood control funds and issued a directive that not more than $185 million of the previously funded $500 million should be spent.[5] It was not the first time, nor would it be the last, that a President would refuse to spend funds appropriated by Congress.

Opposition to the impounding of the funds quickly developed, but the spunky President refused to recind his directive placing restrictions on the expenditure of flood control funds. Nearly 500 representatives of flood control and navigation interests, including approximately forty members of Congress, met in New Orleans to protest the impounding of funds. Resolutions were passed imploring the President to lift the restriction on spending, but Truman ignored them. Nevertheless, pressure for release of the funds continued to mount. In October, 1946, the Budget Bureau agreed to increase the ceiling on flood control expenditures by $35 million.[6] Even with the additional funds allotted to the Mississippi River Commission, it could not meet its current expenses.

In early November, 1946, the River Commission issued orders that the various districts begin to terminate employees. More than 6,800 employees were to be dismissed for thirty days by November 15th. It was thought that all available funds would be expended by December 1.[7] Levee and drainage districts appealed to the President to release the funds because they would be unable to fight even a moderate flood without additional funds. While the levee and drainage engineers were meeting in Memphis, the Mississippi River Commission began the complete decommissioning of all their vast flood control fleets – something unprecedented in River Commission history. Only small maintenance crews would be kept with the fleet.[8]

President Truman had once stated that if any President could not stand the heat, he should stay out of the kitchen. Flood control advocates continued to put heat on the President and the temperature in his kitchen was nearing the danger point. On November 26, 1946, the heat was too much, and he announced that an additional $55 million of impouned flood control funds would be made available. Lower Mississippi Valley's share of the funds amounted to only $13 million – barely enough to resume the operations that had been stopped on November 1st.[9]

Of course, flood control work in the Memphis District was seriously impeded by the impounding of funds. Bids had been invited on several sections of the flood control plan for Memphis, but the invitations had to be withdrawn after the restrictions on letting of contracts were promulgated. Though actual construction was delayed several months, plans and specifications were being made for the many surveys authorized by the Flood Control Act of 1946.

Memphis District work fleet in route to a revetment location.

Revetment work usually begins as soon as river stages drop to acceptable levels, normally occurring in July. Thus, the crews had just began to work when President Truman impounded the flood control funds. Even with the restrictions, bank protection work that year amounted to approximately 15,000 linear feet of both new revetment and extensions of old revetment. For several years, the River Commission had relied on the articulated concrete mattress as its number one revetment. It had proven effective, but expensive. It was known that a large revetment program would have to be undertaken if the authorized twelve foot channel was to be achieved. With this view, the Commission began experiments with a new type of revetment, a more flexible mattress. This revetment was constructed in long, thin slats that were interconnected. The revetment was rolled onto drums, much as a window shade operates. The drums were placed near the water's edge and the revetment rolled onto the banks. But, after several seasons, these experiments were abandoned. The revetment proved to be less expensive than the articulated mattress, but its short life span, and difficulty in launching, made it ineffective as a method of bank protection.

Another interesting but short-lived experiment was tried in the period 1946-1949. In this experiment, the engineers tried hot sand-asphalt mixtures in lieu of the various forms of concrete then being used. The mixture was created under a temperature range of 380 F. to 400 F., and was set in place by simply dumping it out of barges that had trap-doors on the bottom. Spacing of the dumps was designed to cover the area with 5 to 6 tons per square (100 square feet), with double dumps along the upchannel edge.[10] Like most experiments, the hot asphalt attempt was partially successful but not promising enough to replace concrete.

The dumping and spreading of hot asphalt was one of the experiments in bank protection that produced inconclusive results.

Workmen spreading hot asphalt for upper bank paving.

An unusual photo of the Masters and Pilots assigned to three different vessels, the "Chisca," "Coiner," and "Inspector." Since the date of this photo, January 29, 1946, many have become prominent members of the "River Rats," an informal organization of retired District personnel. Back row, left to right: Robert B. Wilkerson, Jr., Wm. H. Tippitt, Henry J. Whitehead, Russell E. Word, Jr., Alva D. Russell, Fletcher W. Mayes, James E. Baughman, Jessie J. Reede, Henry C. Cullen. Front row, left to right: Harry Shoemaker, Lee Campbell, Alex Ranney.

Levee construction and dredging suffered greatly from restrictions in spending. Most of the work was done by contract and restrictions prevented the awarding of any new contracts. Levee construction suffered most as, in the Memphis District, only a little over five million cubic yards of material was placed.[11] Dredging operations were more complex than appearances would indicate: As the high waters begin to recede, patrol boats were dispatched to sound the river for shallow places in the channel. The operatives would radio the soundings back to Engineer Headquarters so that reports could be published giving rivermen and navigation companies up-to-the-minute information on the condition of the channel. At those places where dredging was necessary, the Survey Section drew up plans indicating where and how much dredging was to be done. Once the amount was determined, dredges were dispatched to the crossings to dredge an adequate channel. During the low water season, twenty-nine such crossings were dredged in the Memphis District during the year.[12]

At the beginning of 1947, over $30 million of funds for the Lower Valley remained impounded, and, in his budget message, President Truman asked for reduced appropriations for the River Commission. The President stated that expenditures for the coming fiscal year (1948) had to be restricted to maintenance and to construction of projects under way.[13] Thus, in the early part of 1947, Truman was in the vanguard of the economy move. However, events beyond his control would force him to change his attitude on expenditures for flood control.

In January of 1947, General Raymond A. Wheeler, Chief of Engineers, had noted that, even though progress had been made in controlling floods, between 1924-1945, nearly 2,000 citizens had lost their lives through flooding.[14] Considering these facts, General Wheeler hoped that Congress would restore the cuts being made in flood control funds. In late June and early July, floods hit the Upper Mississippi setting record stages at many localities. At least thirty people were killed and another 35,000 made homeless as thousands of square miles were flooded and millions of dollars worth of property.[15] These floods on the Upper Mississippi caused Truman to re-evaluate his attitude on expenditures. He asked the Congress to spend $250 million in the next twelve months as the first phase of a ten-year program for the entire Mississippi River Basin.[16]

Presidential support of flood control loosened the grip on funds. During 1947, the Memphis District began work on several sections of the Memphis flood control project. Construction of the section 3 floodwall was started and, by the end of the year, was more than fifty percent complete. Construction on section 2 and the May Street pumping station was also initiated.[17]

Bank protection that year took a large share of the funds allotted to the Memphis district as almost 30,000 linear feet of new bank protection was constructed. Levee construction continued at a reduced rate. Less than nine million cubic yards of material was added to the levees. Late in the year, the River Commission allocated a small amount of funds to initiate planning for the Tennessee Chute project.

National elections in 1948 precluded any comprehensive flood control legislation because economy in government was still an important issue across the nation. Therefore, the Flood Control Act approved on June 30, 1948, was essentially an emergency bill. Only those projects deemed absolutely necessary were considered by the congressional committees. Only thirty-six projects were authorized by Congress. The projects carried a price tag of approximately $52 million.[18] Besides authorizing several new projects, the legislation contained a provision that any project costing less than $100,000 could be undertaken without congressional approval if local officials approved the project and its economic justification could be shown.

The Flood Control Act of 1948 authorized two new projects for the Memphis district. The first was a project for the tributaries in West Tennessee. Project operations included realignment, flood control and improvement of drainage along the Obion and Forked Deer Rivers and their principal tributaries, including those areas affected by Mississippi River backwater. The estimated cost was placed at $7.7 million. The second project involved flood control and drainage improvement in the L'Anguille River Basin in Arkansas at an estimated cost of $5.1 million.[19]

During fiscal 1948, the Memphis Engineer District was allotted more than a million dollars to continue work on the flood control project for Memphis; however, only about one-half of the amount was expended. Planning and design were continued on the unfinished portions of the project. The section 3 floodwall and bank protection on both sections 2 and 3 were completed. Work on the May Street pumping station was about 85 percent complete.[20] During the year, an unfavorable report on flood control and navigation of the Hatchie River in Tennessee and Mississippi was submitted.

Dredging to maintain channel depth is an endless operation.

Dredging operations consisted of the removal of more than thirty million cubic yards of material at forty-nine crossings within the district. Levee construction continued at a low figure. Less than seven million cubic yards of new levee construction was completed during the year as revetment work received the greatest share of the funds allocated to the district. Almost 35,000 linear feet of new bank protection was constructed at a cost of more than $6 million.[21] The Tennessee Chute project was initiated with grubbing and removal of obstructions.

In 1949, the civil works activities of the Corps of Engineers again came under attack. At least three other presidents had led moves to strip the Engineers of its civil works and confine it to military activity.[22] Now the Hoover Commission proposed merging the flood control work under the Interior Department to promote efficiency and economy. As expected, the proposals created a tempest among Engineer supporters. The Engineers were proud and jealous of their almost independent status. Even the Hoover Commission split on the issue, with several members opposing the transfer outright and others opposing giving the work to the Interior Department. As in other attempts to remove the civil activities of the Engineers, the one in 1949 was defeated.[23]

The Engineers' fight to save civil functions, combined with delayed appropriations, resulted in reduced flood control work. Time and money ran out on the Memphis harbor project. During the year, more than a thousand feet of approach embankment to the closure dam was completed and revetment crews constructed 2,600 linear feet of willow fascine revetment on the north end of Presidents Island to protect it from attack by the current after the Tennessee Chute was closed. This willow revetment was the last of its type constructed by the Memphis district.

The art of creating and laying a willow mattress was almost forgotten by that late date, but, fortunately, the Memphis District has a history of long-term employees. Among them was Sam Tucker, the same man who had made the dramatic rescue of two fellow workers in 1927. Tucker was requested by the superintendent of the project and was proud to lend his experience in the construction of this last willow mat. Among the incidents attendant to the construction of the mattress was the belated revelation that one of the best laborers was a woman. The fact that the best "brush hooker" was a woman was not known for several days, and came to light only when the worker approached Paul Brown, the Supervisor, to announce that she was quitting because the work was just "too heavy for a woman." The announcement created quite a commotion at the work site considering the primitive toiletry facilities.[24]

More than 1.2 million cubic yards of material was placed in the Tennessee Chute dam site and approximately 1.1 million cubic yards of dredge spoil was placed on the industrial fill section. Work on the project was stopped by two factors: failure of Congress to appropriate funds and a lack of the working season time left to do all that would be required by the Chute's closure. It was therefore necessary to wait until 1950 to close

The working end of a working Motor Vessel, the "Coiner."

Tennessee Chute because the District Engineer wanted to be sure of an allotment of funds sufficient to permit the closure during the next working season.[25]

Work on the flood control project for Memphis was continued. Construction of the May Street pumping station was complete and contracts were awarded for the construction of both the Fairfax and the Workhouse Bayou pumping stations. Work on the section 6 levee was nearly 85 percent complete and construction of May and Trezevant reservoirs was now about 95 percent complete.[26]

Levee construction in the Memphis district continued at a reduced rate because most of the levees were nearing completion. Approximately 6.5 million cubic yards of new levee was constructed and almost 1.6 million cubic yards were placed as maintenance. Bank protection work continued to expand. Almost 49,000 linear feet of new revetment was placed on the river banks, including that last willow mattress constructed by the Memphis district at Presidents Island.[27] Construction of the St. Francis River project was being pushed. On the west bank, 38.6 miles of levee were to project grade and section and, on the east bank, 44.7 miles were completed. The levees along Little River were 100 percent complete.

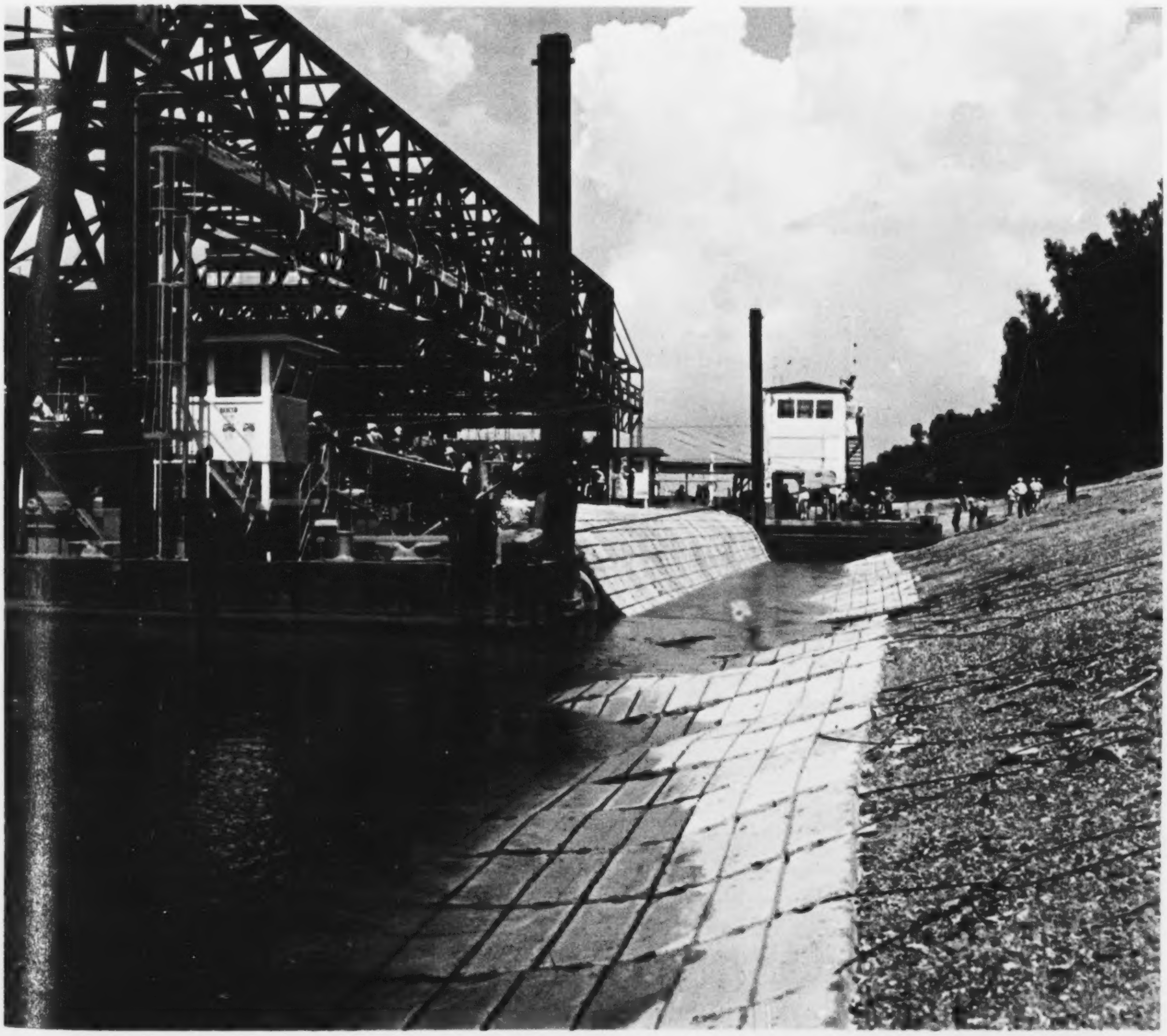
Rains occurring over the upper reaches of the Mississippi and Ohio Basins during January and February caused little trouble for the Memphis district as far as the Mississippi River was concerned. However, for the first

Waterways Experiment Station, Vicksburg, Mississippi. This working model of the lower Mississippi has enabled the Corps of Engineers to predict problems and conditions, and to so contend with them.

time since 1927, the Mississippi River crevassed the levee near Port Allen, Louisiana, to a width of 250 feet. Approximately 5,000 acres were inundated before a loop levee was constructed.[28] In late January, 1949, the Memphis District Engineer ordered "Phase One" of the flood fighting plan implemented. The most dangerous conditions obtained on the White and St. Francis Rivers. Several days later "Phase Two," or mobilization of flood fighters, was ordered for the White River. On the St. Francis River, the Engineers were assisting local flood fighters from Kennett, Missouri to Paragould, Arkansas. The substandard levees could not hold and three crevasses occurred which resulted in minor flooding.[29]

Attempting to hold the Mississippi River to a fixed channel was the most important work performed by the Memphis district in 1950. All previous records for bank protection were broken as more than fourteen miles of new revetment was constructed at seventeen locations and repairs to old bank protection work consisted of placing enough concrete mattresses to cover an area of more than 158 acres. The bank protection program for 1950 cost more than $15 million.[30] Confining the river to a stable channel also required annual dredging. Approximately thirty million cubic yards of material was removed from thirty-six locations in the Memphis district.

During 1950, plans were devised and executed which finally brought about the closure of Tennessee Chute. Final construction of the closure dam resulted in a "happening" upon the river bluffs at Memphis. Spectators by the hundreds came to the edge of the chute to witness the event. The curious and interested onlookers became so numerous that the Engineers had to place a full-time employee there to conduct tours of the project. Other



The Memphis District mat-laying plant at work. Though capable of greater output, the plant will average sinking about 330 squares per hour on a ten hour shift, or 330,000 square feet of articulated mat in a ten-hour work day.

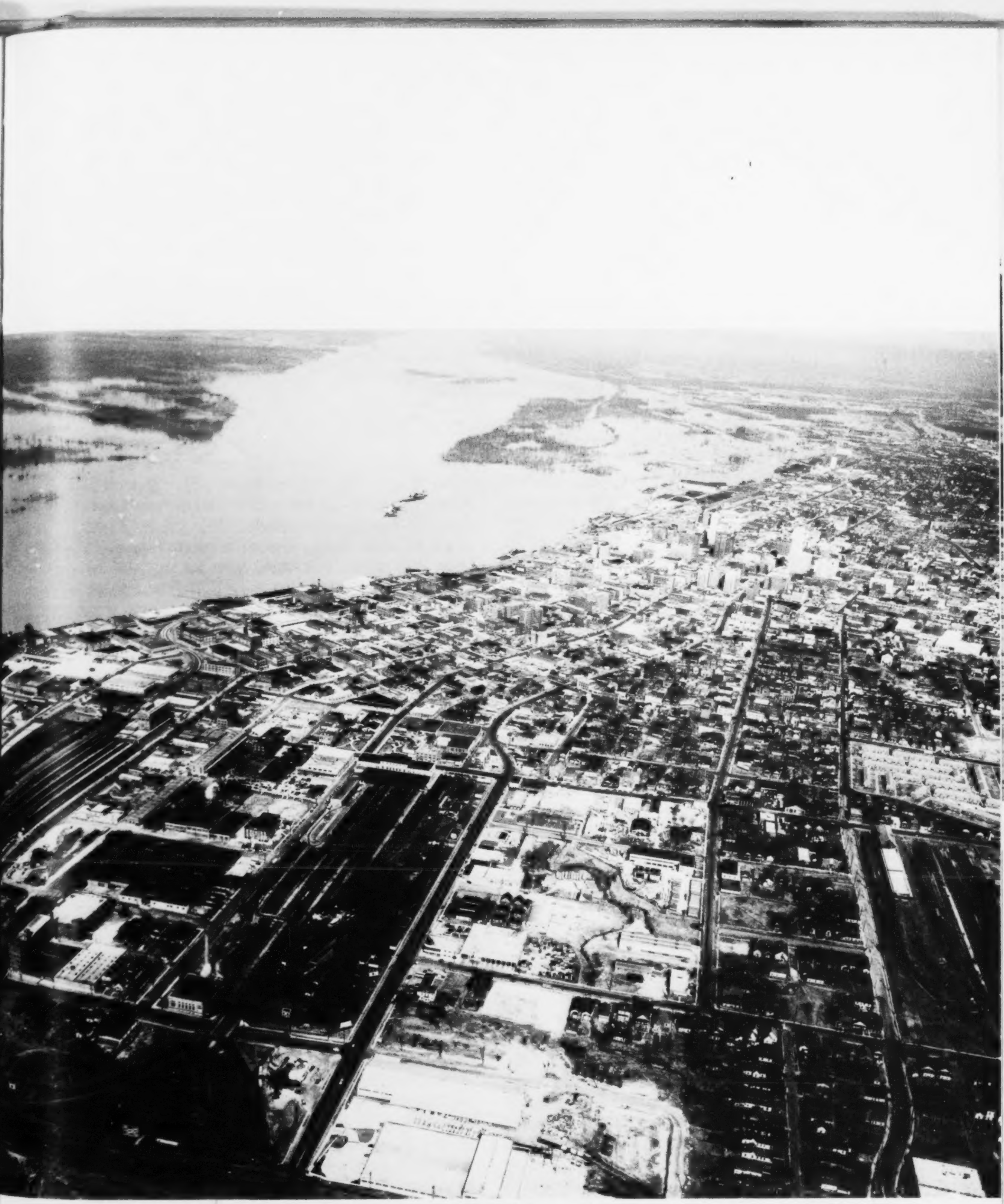
more routine work on the project consisted of placing approximately five million cubic yards of material on the industrial site and the clearing of 180 acres.[31]

Levee construction was mostly confined to the tributary streams and backwater areas but approximately 6.6 million cubic yards of levee were constructed during 1950. On the St. Francis River project, 44.6 miles of levee on the west bank and 56.4 miles on the east bank were now up to grade and section. In the White River Basin, the 32 miles of the Augusta to Clarendon levee was complete, in addition to the levee protecting Clarendon. Flood protection for DeValls Bluff was complete, except for the pumping plant and sump area, which were being redesigned.[32] Work continued on the flood control project for Memphis. The Section 6 levee, along with May and Trezevant reservoirs and Fairfax pumping station were completed. The workhouse pumping station was about 80 percent complete. As of 1950, sections 8, 4, and 2 levees, section 3 floodwall, Nonconnah Creek, Cypress Creek, and May Street pumping station had been turned over to the city for maintenance and operation.[33]

Heavy rains over the Mississippi River and Ohio River Basins produced the highest crest stages on the Mississippi above Helena since 1937. At Memphis, the river crested at 41.75 on the Beale Street gage on February 22nd. In early January, Colonel Lewis H. Foote, District Engineer, ordered that Phase Two of the flood fighting plan be placed in operation on the St. Francis River. A heavy ice storm made the flood fighters job most difficult. On January 13th, a private levee crevassed near Paragould, Arkansas inundating approximately 5,000 acres. Before the flood fight was over, four additional crevasses caused substantial flooding.[34]

The Mississippi River Commission announced that though there was no general alarm at the time, conditions in January, 1950, were similar to conditions prevailing during the early months of 1927 and 1937, when major floods hit the Mississippi Valley. As the river continued to move above the flood stage, Colonel Foote ordered mobilization of flood fighters for the Cairo area. On January 16th, the residents of the Birds Point - New Madrid Floodway were warned by the Engineers that the floodway might have to be placed in operation on short notice. The next day, autos, trucks and wagons of farmers, driving their livestock before them, could be seen making their way out of the floodway.[35] At the same time farmers were warning the Engineers that they would not tolerate the flooding of this land. Operation of the floodway was to commence when the river stage at Cairo reached 57 feet, however, the Weather Bureau had predicted a crest of only 55.5 feet at Cairo.

Memphis Engineer District alerted all the levee districts of the danger and made preparations for the flood fight. Levee patrols were established to identify dangerous areas. On January 18th, a private levee near Boothspoint, Tennessee crevassed, flooding an area fifteen miles long and at least four miles wide.[36] Other than this crevasse, most of the flooded area in the district was from backwater. By the end of February, the worst was over and residents of the Birds Point - New Madrid Floodway were told that they could return to their homes. However, they were warned that the high water season was not over and no assurance could be given that another crest might not force them to move again. Along the Lower Mississippi, the damage from the flood was estimated at $6.6



1950 Flood fight at Memphis. Note work fleet at upper left-center of picture. Though apparently in midstream, the fleet is actually moored to one side of submerged Mud Island.

million, but work on the flood control project had progressed to a point where it prevented damages estimated to be about $19 million.[37]

The flood control project was approximately 60 percent completed and there had been no general overflow since 1927. It was estimated that 20.3 million acres of land with a population of over 1.2 million was receiving protection from floods. Since enactment of the Flood Control Act of 1928, it was also estimated that the project had prevented accumulated flood damages totaling about $5 billion. The costs of the project to 1950 had been almost $857 million. Thus, the project had returned over five dollars in benefits for every dollar invested in the work.[38] Even with this degree of flood protection, the residents of the Lower Mississippi Valley wanted more. The result was a concerted move for a new omnibus river and harbor and flood control authorization act.

On May 17, 1950, President Truman signed into law the first major flood control legislation since 1946. In addition to providing authority for the construction of numerous navigation projects throughout the nation, the act authorized the initiation and continuation of all types of flood control projects.[39] The Flood Control Act of 1950 authorized three additional projects for the Memphis district.

The Cache River Basin drained approximately 2,000 square miles in Arkansas and Southern Missouri. In 1941, the District Engineer had submitted an unfavorable report on flood protection for the basin. Residents again expressed an interest in flood control in 1944 at a public hearing, but a subsequent report was again unfavorable. New hearings were held in 1946, this time resulting in a favorable report. The plan of improvement provided for enlargement, and in some areas, relocation of the channel. The Flood Control Act of 1950 authorized the controversial project at a partial cost of $10 million.[40]

Des Arc, Arkansas is a small community located on the White River. The Memphis district was already constructing a levee from Augusta to Clarendon and the Little Rock district was constructing several reservoirs upstream from Des Arc. The inhabitants of the community were determined to have flood protection from the White River. The Flood Control Act of 1950 authorized a plan of protection being recommended by the Memphis District Engineer. At an estimated cost of $228,000, the plan called for construction of an earth levee, a pumping station, a floodgate, diversion ditches, and the relocation of sewage facilities.[41]

The Flood Control Act of 1950 authorized protection from backwaters for the St. Francis River. This project is a good example of what is involved in getting a flood control project approved. In 1946, the East Arkansas Drainage and Flood Control Association was formed with a view toward seeking protection from backwater flooding. The group hired an engineer to make an initial survey and, in 1948, Congress authorized the District Engineer to make a preliminary survey. In 1950, a plan of flood protection was authorized, but it was two years more before appropriations were made. The recommended plan consisted of extending Steep Gut Floodway to the mouth of L'Anguille River and to its junction with the Mississippi at Whitehall, Arkansas. Other features included the realignment of the channels of the St. Francis, St. Francis Bay, and Straight Slough Ditch, plus a pumping station and floodgate near the mouth of St. Francis River, additional protection on White River, and enlargement of Big Slough Ditch. When finished, the project was projected to cost approximately $51.1 million.[42]

The General Appropriation Act of 1951 curtailed the civil works activity of the Corps of Engineers by $75 million. That was in line with a presidential directive to reduce non-defense expenditures to those deemed essential. The international aspects of the Cold War had thus come to roost in the domestic program. On the other side of the world the North Korean invasion of South Korea had brought immediate response by President Truman, and even though the United Nations officially took over the defense of South Korea the United States would provide the bulk of logistical support. At home the funding of the "Police Action" forced a reorientation of priorities, and once again flood control was moved down the list. All types of work except for bank protection suffered from the effects of the war. The Workhouse pumping station, a part of the flood control plan for Memphis, was completed, but work on Marble Bayou pumping station and section 7 was approximately 60 percent complete.[43] Much of the work by the district was now devoted to investigations. Thirty-six flood control and navigation projects were in the investigatory stage that covered the entire area under jurisdiction of the Memphis Engineer District.[44]

During fiscal 1951, the approach embankment to the Tennessee Chute dam was completed. More than 66,000 linear feet of permeable pile dikes were furnished. Dredging operations in connection with the harbor project consisted of placing approximately ten million cubic yards of material on the dam and industrial site and by removing it from the chute channel. Though not a direct part of the harbor project, approximately 4.6 million cubic yards of channel improvement dredging was taken from the channel near Presidents Island.[45]

Levee construction amounted to less than six million cubic yards, however, the construction of floodwalls was related to levee construction. Floodwalls were under construction at Hickman, Kentucky, and the one at Cairo was completed and turned over to local interests for maintenance and operation. On the St. Francis River, 57 miles of west bank and 62 miles of east bank levees were completed to grade and section. Thirty-two miles of the Augusta to Clarendon levee were complete. Levee related construction during fiscal 1951 amounted to more than five million dollars,[46] but bank protection work continued to take a major portion of the Memphis Engineer District budget. Approximately 80,000 linear feet of new revetment was placed on the banks at a cost of more than $11.5 million.

The deepening crisis in Korea resulted in a continued slow down for flood control work. Nevertheless, most of the people who lived behind the levees in the Lower Mississippi Valley thought it was the Federal Government's responsibility to provide protection from floods. Each time there had been high stages on the Mississippi or its tributaries, there had been renewed agitation for more flood protection. Even though a war was being fought in Korea, many individuals believed that the government could provide both "guns and butter."

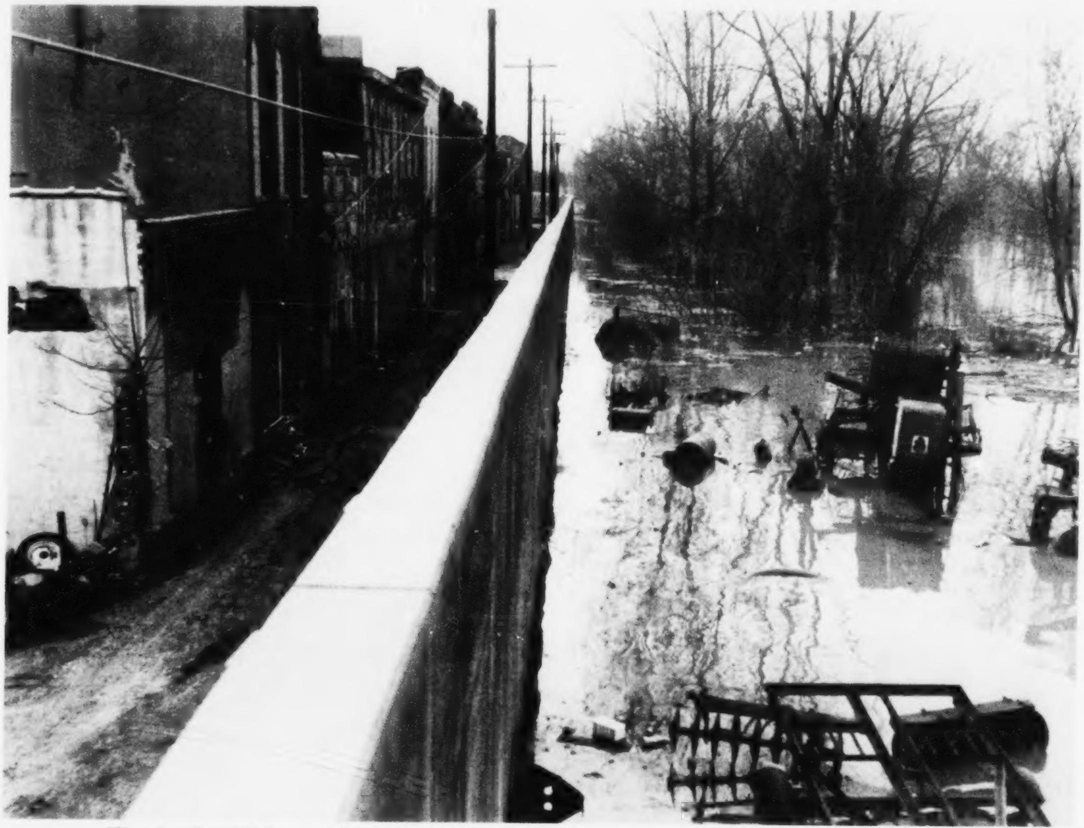
Over decades of efforts to control the Mississippi and other inland streams, the United States had expended more than eleven billion dollars. In spite of this great expenditure, the Mississippi and its tributaries had taken the lives of 1,282 people during the flood seasons between 1924 and 1942.[47] The nation-wide total of fatalities were naturally much greater, and floods on the Missouri River in 1952 added to that total. These floods were causing so much havoc that the Mississippi River Commission was called on to send flood fighters to the area. Four special railroad cars carried 100 flood fighters from the Memphis district to the Omaha district and other districts in the Lower Mississippi Valley Division also sent hundreds of flood fighters. All districts were placed on a twenty-four hour alert to meet further requests from the Missouri area.[47]

Work in the Memphis district continued even though numerous employees were in Missouri fighting the floods. Construction of the flood control project for Memphis was nearing completion. Marble Bayou pumping station was 99 percent complete and section 7 was virtually complete. The Tennessee Chute project was turned over to city officials for operation and maintenance, but the Engineers would continue to dredge and build up the industrial site for several years.[48] On the above project, the revetment of Presidents Island was extended downstream 5,600 linear feet. Approximately 350 acres of the industrial site were above the project flood.

A Farewell party for Lt. Col. R. C. Bahr, Asst. Dist. Engineer, aboard the MISSISSIPPI III, August 22, 1952. Left to right: Paul E. Gieselmann, Mrs. Ruth Hartley, Mrs. Aliene Tanner, Mr. Jack Carley, Mr. Harold Baker, Captain David Cook, and Lt. Col. R. C. Bahr.

Revetment work continued to outstrip levee construction. Approximately 7.3 million cubic yards of material was placed on the levees in the Memphis district. On the west bank of the St. Francis River, 64 miles of levee was complete, and on the east bank, 62 miles of levee was complete. The Hickman, Kentucky, floodwall and protection works for DeValls Bluff, Arkansas, were completed and turned over to local interests.[49] Bank protection work continued to break previous records. In 156 working days, more than 448,690 units of articulated concrete mattress were placed on the banks of the Mississippi River.[50] The total length of the river banks protected by revetment was approximately 71,000 linear feet.[51]

The Eisenhower Administration took the reigns of power in the national capital in 1953. At once a program to halt so called "creeping socialism" was instituted. One of the first areas that was hit by cuts in appropriations was the national flood control program of the Corps of Engineers. In late August, 1953, the Budget Bureau instructed the Engineers to spend no more than 500 million dollars out of its total of more than 750 million dollars in appropriations and unexpended balances.[52] The Memphis district



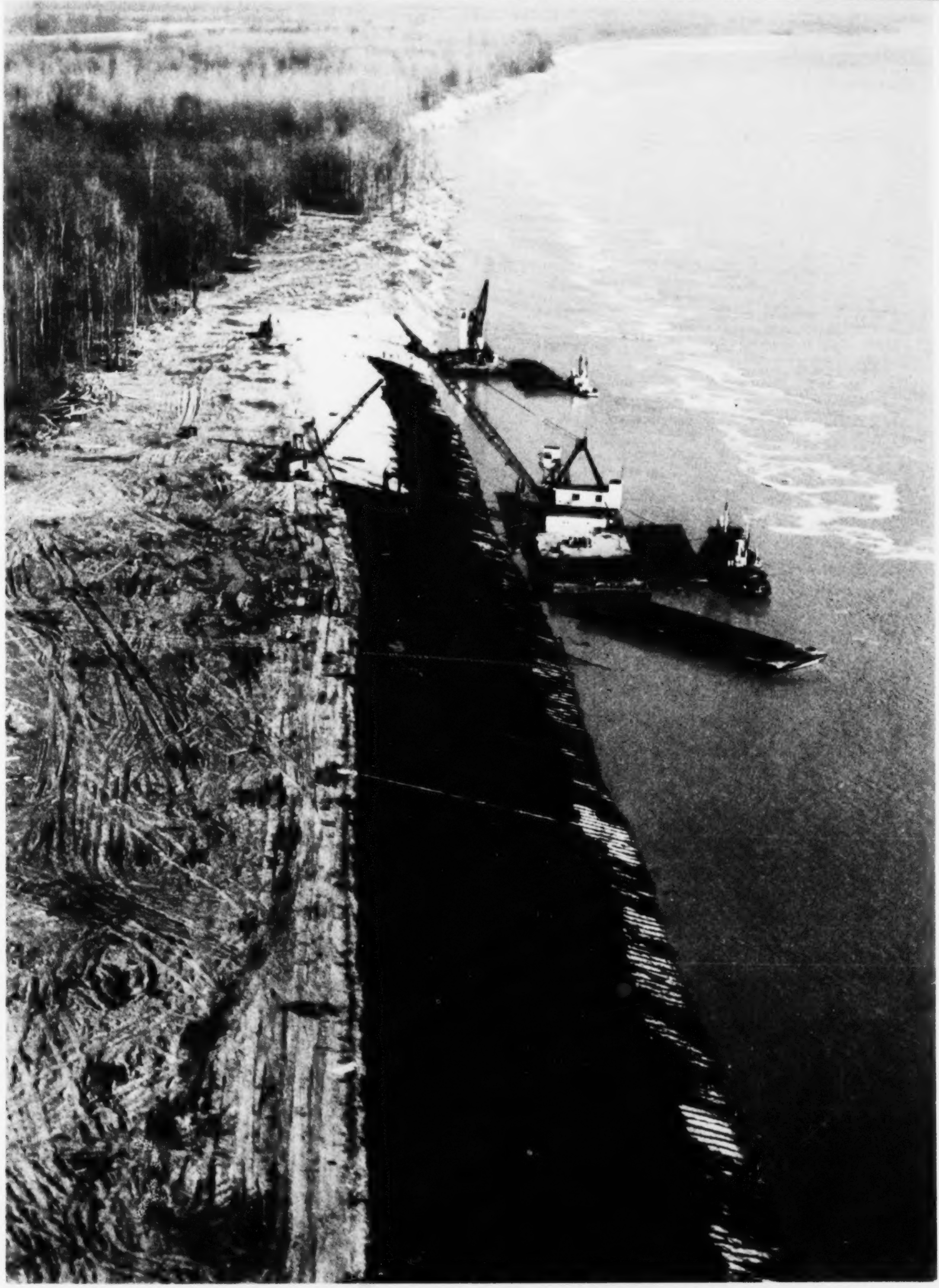
Floodwall at Hickman, Kentucky, doing the job for which it was intended. Flood of 1973.

was affected very little by the impoundment of flood control funds. Even though some awarding of contracts were delayed and a few employees were discharged, flood control work continued at a rapid pace.

As a part of the drive to cut down necessary expense, the Memphis district was ordered to reduce inventory to the bare essentials. Accordingly, the District Engineer, Col. Allen F. Clark, Jr., was advised that the district inventory was ready for inspection. When the General Accounting Office sent a team of inspectors, the Colonel took them on a personally conducted tour of the material yard. There, to his embarrassment, was a 12 inch wrought-iron shaft that could only fit a steamboat that had been junked in 1926. "We looked a little bit silly," said the Colonel in reminiscing.[53]

Levee construction was expanded slightly during 1953. Approximately 11.5 million cubic yards of material was added to the levees. Construction was now 84 percent complete, but it would take another 475 million cubic yards to finish. Levee construction for the previous decade had averaged about ten million cubic yards a year and, at this rate, it would be several decades before the levees were completed to grade and section.[54]

Colonel Allen F. Clark, Jr., District Engineer, announced a program that contemplated the construction of gravel roads on the levees. For several years the district offices had constructed dirt roads on the levees. This new program would be developed over many years with the Engineers assisting the local levee districts by stockpiling gravel. W. G. Huxtable, Chief Engineer of the Lower St. Francis Levee District, revealed that his district had constructed fifty gravel roads leading to the levees to facilitate flood fighting. In 1937, the levee district had only thirteen such roads and access to the levee had been a major obstacle in fighting the flood of that year.



A panoramic view showing the various stages of bank paving. In the background is the unimproved River bank, then we see a section where the growth has been cleared and the bank is being prepared to proper slope. At the center of the picture we see the hot asphalt being laid as upper bank paving. At the bottom of the picture is the finished product, with the hot asphalt extending to near the waterline, where articulated concrete mats then commence as the subaqueous paving. A good example of efficient use of appropriate materials.

Revetment construction in 1953 was expanded because of the long low-water season. More than 121,000 linear feet of bank protection was placed by the Memphis district. Low river stages were important to revetment construction, but they created other problems. In 1952, the Mississippi at Memphis had dropped to its lowest level since 1895, and, in 1953, the record was broken. On November 21, 1953, the river dropped to -3.5 feet on the gage, the lowest stage of the river since stages began to be recorded in 1872.[55] Such low stages created many problems for the Dredging Section. During the low water season of 1952 and 1953, the dredging fleet had to be employed at 114 locations and, at these crossing, dredges had to be operated 182 times. More than seventy million cubic yards of material was removed.[56]

In 1954, the Mississippi River Commission reported that flood control in the Mississippi Valley had progressed to the point where most of the inhabitants were safe from a flood similar to the great 1927 flood. Seventy-five percent of the bank revetment had been completed and only 250 miles of main line levee remained unfinished. Only ten miles of the river was without some type of levee, though a levee might not be completed to grade and section.

The Mississippi River Commission celebrated its 75th Anniversary in 1954. Several activities were planned for the Commission's semi-annual inspection trip in the spring and several prominent magazines and newspapers were giving coverage to the event. The Commission used the steamer *Mississippi* on its inspection trips. Normally the boat would

A famous picture of the last working stern-wheeler named the "Mississippi." The "Mississippi III" is shown here pushing an easy load of two barges of fuel oil. August 17, 1954.

make its way to Cairo where it picked up the Commission and carried it down the river to the Head of Passes. In 1954, the steamer was making its way to Cairo when her stern wheel shaft broke in half. If the boat could not be repaired, a boat with lesser accommodations would have to be used. Memphis district personnel quickly sent aid to the stricken steamer, but repairs could not be affected. A towboat was secured and the proud steamer *Mississippi* was pushed up to Cairo. The trip down the river was made, trying to conceal as much as possible the fact that the *Mississippi* was being towed. The concealment was effective. Most of the writers on the steamer were unaware of her condition.[57]

Chief of Engineers, General Samuel D. Sturgis, made the trip with the Commission. At every stop along the river the Commission was greeted by dignitaries. The Commission and Chief of Engineers used every opportunity to praise the work that had been done, but at the same time, they warned that additional work would be needed before the Lower Valley would be safe. General Sturgis pointed out that as each year passed the Lower Valley was brought closer to the day when a great flood of unforseen proportions would hit the Valley. It was only common sense to be prepared, as well as possible, to meet such a flood.[58]

The River Commission's efforts to control the Mississippi was being prosecuted within the framework allowed by appropriations. Though a truce had been forced in Korea, President Eisenhower in his first two budget messages had called for reductions in flood control funds. It was the position of the Commission that they had to have some knowledge of the approximate amount of appropriations that would be forthcoming. If there was going to be a ceiling on funds, there should also be a low point below which funds would not be allowed to go. The Commission had built up a technical organization and the personnel would not, and could not, continually be laying off and calling these people back to work.

The uncertainty of appropriations was reflected in the work accomplished. Levee construction remained about the same as in past years, amounting to a little over twelve million cubic yards, but bank protection work declined. Bank protection construction was approximately 84,000 linear feet.[59] Work on the Memphis harbor project was about 85 percent complete and approximately 617 acres of the proposed 960 acre industrial fill was completed. The construction of a levee and pumping station at Des Arc, Arkansas was finished in 1954.

For the past several years, the Memphis district had been excavating drainage ditches in Arkansas and Missouri to provide better drainage and flood control. Proposed and completed projects to provide better drainage consisted of excavating approximately 148 million cubic yards. The most ambitious of the projects was on the St. Francis River. More than 75 million cubic yards would have to be removed to provide flood protection and one part of the project contemplated the removal of 24 million cubic yards in the Madison-Marianna, Arkansas, Floodway alone. Work on this feature of the St. Francis project was begun in 1954 with the removal of about 2.8 million cubic yards.[60]

Three days after the holocaust of a petroleum barge fire, the remains continue to smoulder. Oct. 4, 1954.

Dredging operations were a major feature of the work performed in 1954. For the third consecutive year, the Mississippi dropped below the zero stage at Memphis. The Memphis district proved its skill at overcoming low-water hazards when a towboat with three heavily loaded barges lost the channel near Luxora, Arkansas, and went aground. Six other tows were unable to pass the grounded tow. The Dredge *Burgess* was working about twenty miles upriver and it was ordered to proceed to the aid of the stricken tow and deepen the channel. However, before the dredge arrived, the Memphis Engineers rushed to the area in a speedboat, found a deeper channel, and all but one barge of the grounded tow was cleared.

A part of the Memphis district personnel became fire fighters in 1954. A series of rocking explosions at the Esso (Exxon) Standard Oil Company's river terminal was started as fire spread through ten barges loaded with millions of gallons of gasoline. The blasts started a fire that was still burning the next day. In the effort to fight the blaze from the river, the Memphis Engineer District furnished a towboat and barges to the local fire department. When the explosions occurred, it wrenched four burning barges loose from their mooring and set them free on the river. The four floating infernos were forced to the river banks by equipment and personnel furnished by the Memphis District.[61]

On September 3, 1954, the River and Harbor and Flood Control Act of 1954 became law. This legislation authorized the construction of 1965 individual projects across the nation. In the Memphis district, two new projects were authorized pertaining to the Birds Point - New Madrid Floodway and to Reelfoot Lake in Northwest Tennessee. For several years, residents of the floodway had been complaining of backwater flooding from the lower end of the floodway. The new project authorized the construction of a new levee extending from the fuse plug section of the frontline levee across an existing gap to the setback levee; enlargement of adjacent frontline levee grade; and the construction of a floodgate for the release of interior drainage.[62] Long range plans for improvement of the Reelfoot Lake area contemplated flood control and major drainage improvements with land erosion and lake sedimentation prevention. However, the flood control act only authorized better drainage by the improvement of Running Reelfoot Bayou and Bayou du Chien.[63]

In response to a Senate Public Works Committee resolution, the Mississippi River Commission began a comprehensive review of the project for flood control from the Head of Passes to Cape Girardeau, Missouri. The purpose of the study was to recommend any modifications that the Commission thought were necessary. The report was to cover the need for navigation improvements on the main stem, the adequacy and cost of flood control features of the project, and the co-ordination of these features with the plans of other Federal and State agencies in the Lower Valley. The Public Works Committee wanted the report finished by 1958, but because of the scope of the report, it was not finished until 1964.

During 1955, the District Engineer held several public hearings within the district to obtain both citizens and government officials views on any modification of the project. In the meantime, other work was carried forward. For the fourth consecutive year the Mississippi at Memphis dropped below the zero stage. Forty-four locations in the district were dredged seventy-two times. Revetment construction consisted of placing 15.7 miles of new protection on the river banks and more than thirty million cubic yards of material was moved. Levee construction was approximately thirteen million cubic yards. On the St. Francis project, 73 miles of the west bank and 88 miles of the east bank levee were completed. A total of six miles of channel improvement and cutoffs on the Lower St. Francis River in the Madison-Marianna Floodway were completed. Work on the Memphis harbor project was about 60 percent complete.[64]

Work on the Mississippi River and Tributaries Project was being constructed as rapidly as appropriations would permit. In 1956, funds were made available for one of the most ambitious projects ever undertaken by the Memphis District. The project involved relocating five miles of the Mississippi River near Memphis, and it would take more than a decade to complete the work. Stabilization of the river was made necessary by the construction of a network of interstate highways, primarily the construction of a new bridge across the river at Memphis. The river channel there had been unreliable and expensive to maintain, and objections to the construction of the bridge were voiced by the Corps of Engineers until the river was brought into proper alignment.

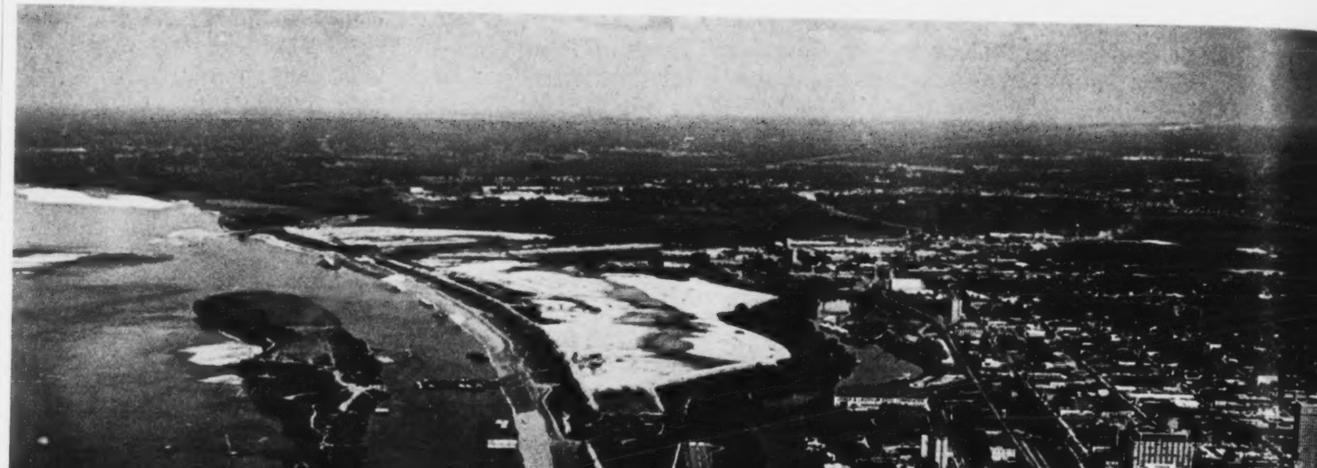
Work on stabilizing the fifteen mile reach of the river began in 1956. The plan of alignment required dredging, bank protection, and construction of dikes to close off secondary channels. Dredging operations required the removal of approximately 33 million cubic yards from the western portion of Mud Island. Since placement of such a volume of dredge spoil in the river would have detrimental consequences for the river channel, it was decided to dredge a pilot channel through Mud Island adjacent to the line of stabilization. Dredge spoil from the pilot channel was placed at prepared locations near Wolf River diversion channel and on what remained of Mud Island. The dredge spoil placed at these two locations eventually raised the areas approximately twenty feet, elevating them above the project flood.

After completion of the pilot channel, the east bank of the channel was protected by revetment. The portion of Mud Island west of the pilot channel was removed by dredging, and placed on the west side of the river where the Robinson Crusoe and Loosahatchie Bar dikes were used to align the river near the bridge site. By the late 1960's, the project had progressed to a point where construction of the bridge could be initiated and, except for the dikes needed on the right bank near the bridge location, the plan of stabilization was completed in 1972. Construction equipment necessary for erecting the bridge was located where the dikes were to be built, preventing the building of the dikes until the bridge was completed. The bridge was completed and opened to traffic in August of 1973.

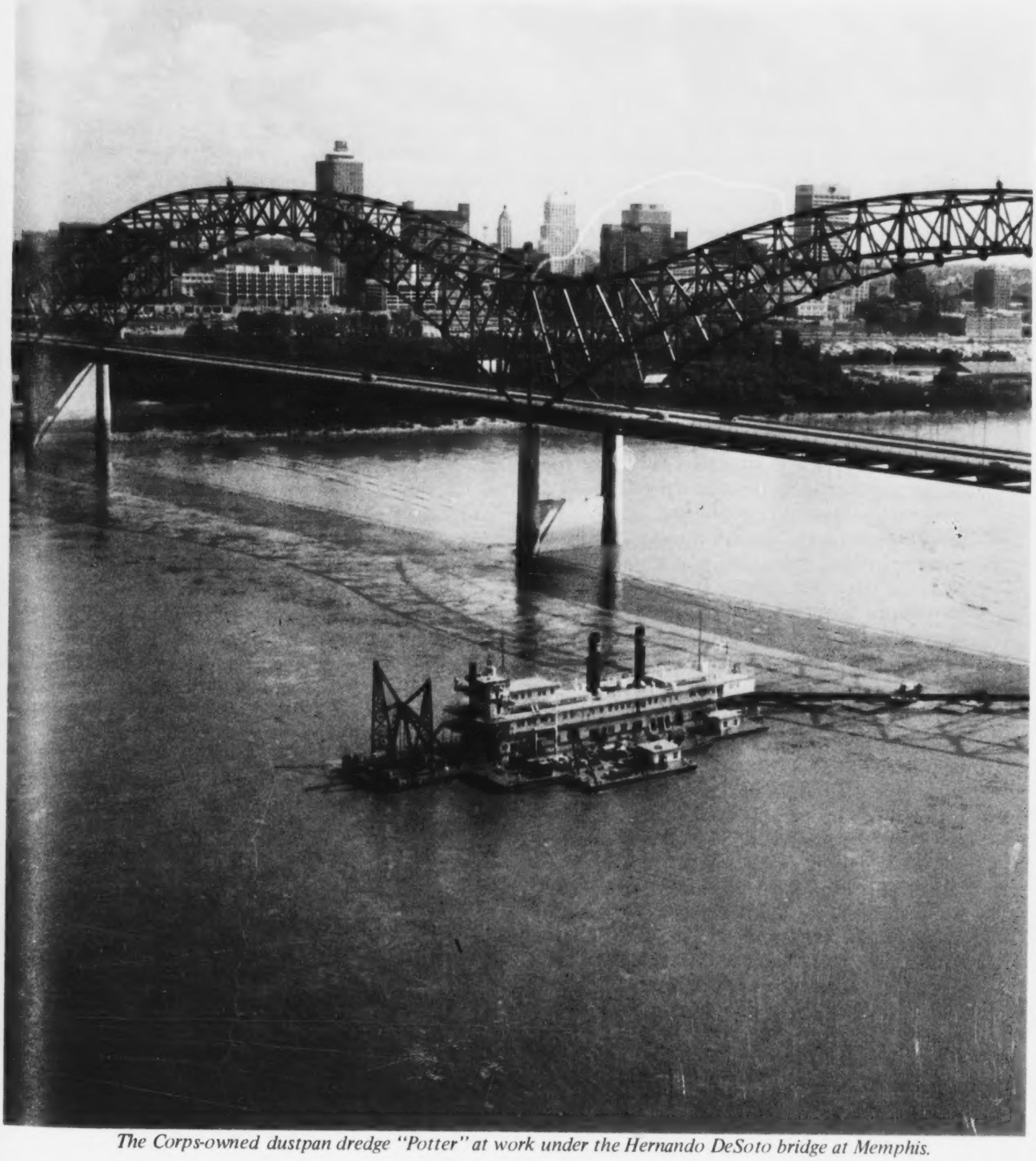
New levee construction during 1956 in the Memphis District was approximately fourteen million cubic yards and approximately twelve million of this total was in the construction of the St. Francis River project. Levees completed to project grade and section amounted to 168 miles. Also as a part of this project, work was initiated on the clean out of the lower five miles of L'Anguille River. Construction of the White River backwater levee was 94 percent complete.[65]

Revetment and dredging continued to take a major portion of the funds allotted to the Memphis District. More than 93,000 linear feet of revetment was placed on the banks of the river during 1956. Approximately eleven million cubic yards of material was excavated from the Madison-Marianna Floodway as part of the St. Francis project and excavation in the floodway was nearly complete. More than 4.7 million cubic yards of material was placed on the industrial fill on Presidents Island as part of the Memphis harbor project. Dredging operations in the Mississippi River in the Memphis District was approximately thirty-four million cubic yards. Thus, the grand total for dredging operations conducted by the Memphis District was in excess of forty-nine million cubic yards.[66]

For thirteen consecutive years, beginning in 1952, the Mississippi River at Memphis dropped below the zero stage on the Beale Street gage. On January 24, 1956, the Tennessee and Arkansas shores of the Mississippi River came closer together than ever before recorded at Memphis. The river dropped to -5.19 feet on the Beale Street gage



Before the new Hernando DeSoto bridge could be constructed at Memphis, the engineers had to realign the Mississippi River. The western part of Mud Island was alienated by a channel, then the isolated portion was removed by scouring action and dredging. The new bank of Mud Island was stabilized by revetment, and the force of the new channel then removed the sandbar at the lower left of the picture.



The Corps-owned dustpan dredge "Potter" at work under the Hernando DeSoto bridge at Memphis.

and -5.4 feet on the Weather Bureau gage near the river bridges. Three days later, representatives of levee and drainage districts were in Memphis for the annual high water conference to map strategy and prepare for the high stages expected in the spring. A high water conference occurring during record low stages of the river might appear strange, but the Mississippi River at Memphis can increase its stage from zero to nearly fifty feet in only a matter of weeks.

There was no high water fight in 1956 because the Mississippi River at Memphis never reached flood stage. In July, the river began another slow decline and dropped to the zero stage on September 26th. For seventy-nine days, the river was again below the zero stage, culminating in a stage of -4.6 feet on October 24th. During 1956, the Mississippi River at Memphis was below the zero stage for an amazing 111 days.[68]

Late in 1956, the situation became so critical that the Supreme Court of the United States was asked to authorize a temporary diversion of the waters of the Great Lakes by way of the Illinois River. The Mississippi flow, if augmented in this manner, would be restored to proper channel depth. In 1930, the Court had ruled that 1,500 cubic feet per second could be withdrawn from the Great Lakes but, even with this withdrawal, barges were forced to lighten loads for shallow channels. In December, 1956, the Supreme Court gave permission to divert 8,500 cubic feet per second for approximately a month and opened the way for larger diversions if it became necessary. However, late in the year, the river began to rise and additional diversion was unnecessary.[69]

Flood control and navigation work on the Lower Mississippi ran into funding problems during 1957. Appropriations were about the same as in previous years, but the Budget Bureau ordered the Department of Defense to cut its civilian employees. In Memphis, the order resulted in the dismissal of 228 employees – most of them from the revetment crews.[70] Even with this manpower reduction, bank protection work was comparable to past years. At twenty locations, the revetment crews placed more than 86,000 linear feet of bank protection and approximately 13,000 feet of dikes were constructed.[71] Nearly eleven million was expended on all channel improvements during the fiscal year.

Levee construction dropped to its lowest figure in several years. In the Memphis District, the levees were 92 percent complete, and the little over four million cubic yards placed during the year mainly consisted of strengthening the existing levees. Levee construction were to continue at this reduced rate until the grade and section specifications were increased.

From the allocations of funds in the Memphis District, it can be seen that two or three projects were receiving the major portion of funds. During fiscal 1957, more than $14.5 million was expended on new construction. Of this total, more than $13.2 million was expended on channel improvements, the St. Francis River project, and the Memphis harbor project. Of a total of $6.1 million devoted to maintenance cost, $5.6 million was allotted to channel maintenance.[72] The Presidents Island portion of the Memphis harbor project was now complete, but city officials began to press the Engineers for construction of the Ensley Bottoms project (Pidgeon Area) to provide additional industrial sites.

In one of the incidents demonstrating the human side of Corps personnel is the story of the "spittoon controversy." The incident began to develop just as Colonel E. B. Downing was concluding his tour as the District Engineer (1954-1957). As always, the District Engineer had solicited suggestions from Corps employees, and among the apparently valid suggestions was one from a young lady who suggested that spittoons be eliminated as "relics of earlier and more vulgar days." To add validity to the suggestion, the young lady further pointed out that the custodial contractor might reduce his price if he did not have to contend with the "vulgar" devices. Wheels were set in motion; the Colonel finding that the contractor would indeed be happy to reduce his contract price if relieved of spittoon cleaning. The spittoons were removed, and the young lady was given an award. Then came the backlash; some personnel decried the loss of their beloved spittoon, and some secretaries complained loudly that their bosses had begun to use their trash baskets as spittoons, causing them great grief when they had to dig out a draft. As the morale of the office began to drop, Colonel Downing gratefully accepted his transfer and left his successor, Colonel William P. Jones, Jr., to contend with the vexing problem. Colonel Jones, besieged on all sides with what must have been considered a minor problem finally ordered the Chief of the Office Service Division, Mr. James K. Prather, to produce a list of "hard-core spittoonists," so that he could deal with them individually. The list revealed twelve men and, since they were old employees fixed in their ways, Colonel Jones finally agreed to leave them with their private spittoons; the Custodial Contractor agreed to clean those twelve spittoons without additional charge. On the morning after the situation was finally resolved, Colonel Jones was surprised to find that a bright, shiny spittoon had appeared by his desk. Although the Colonel neither chewed nor spit, Aline Tanner, his secretary, was not going to see him cheated.[73]

In 1958, the economy of the nation began a downward spiral and President Eisenhower called for a vast program of public works to shore up the sagging economy. In addition, the President called for the appropriations for river and harbor and flood control works to be increased by $125 million. By April, 1958, the Congress had a $1.5 billion authorization bill ready that included navigation work, beach erosion, power projects, and flood control. Despite his call for more spending on public works, the President vetoed the bill – just as he had vetoed a similar bill in 1956.[74]

Congress began an immediate search for votes to override the veto. Eisenhower then had a change of heart and sent to Congress a list of 137 projects he would approve if Congress would modify them according to this recommendation. On July 13, 1958, President Eisenhower signed into law a Rivers and Harbors and Flood Control Act with authorizations of more than $1.55 billion.[75] This act provided two new projects for the Memphis Engineer District. The first of the two projects was a modification of the White River backwater levee.

The White River backwater levee was almost complete and was designed to hold the waters of the White River out of the Mississippi River when the Mississippi was at high stage. Flood control on the Mississippi had progressed to a stage where it could take more of the backwater and the people of the area wanted storage in the sump area reduced. The Flood Control Act of 1958 provided for the construction of a pumping station at a cost of $2.3 million, which would reduce flood damages on more than 40,000 acres and improve drainage on an additional 41,000 acres.[76]

The second of the new projects dealt with Wolf River at Memphis. In 1917, the river had been diverted along the Memphis front in the hope that it would help wash away Mud Island. In subsequent years, floods on the Wolf and backwater from the Mississippi had damaged the harbor facilities on the lower three miles of the river. Pollution and obnoxious odors caused by industrial waste and municipal sewage also caused a problem for the downtown area. In 1956, Memphis Engineer District held a public hearing to determine a plan of improvement. Such a plan had been incorporated into the river and harbor bill of 1956, vetoed by President Eisenhower. The Flood Control Act of 1958 authorized such a project.

Improvement of Wolf River consisted of realignment and enlargement from mile 38 downstream to mile 3.5 near North Second Street. This would give the stream an increased capacity to carry floodwaters. From mile 3.5, the project provided for the diversion of Wolf River westward into the Mississippi by means of 0.6 mile channel across Mud Island. The old channel would be closed off by a dam and the enlargement of Loosahatchie Chute, into which, Wolf River would be realigned and cleaned out. Thus, Wolf River from mile zero to mile 3.5 became a still-water port, just off downtown Memphis.[77]

Early in 1958, the Federal Government relaxed the restrictions on federal funds that it had imposed late in the previous year. More than seven million dollars of flood control work was placed under contract during June by the Memphis District, the largest amount for a given month in many years. A majority of the allotments were devoted to the channel stabilization program. Approximately 73,000 linear feet of revetment and more than 12,000 feet of dikes were constructed during the year.[78]

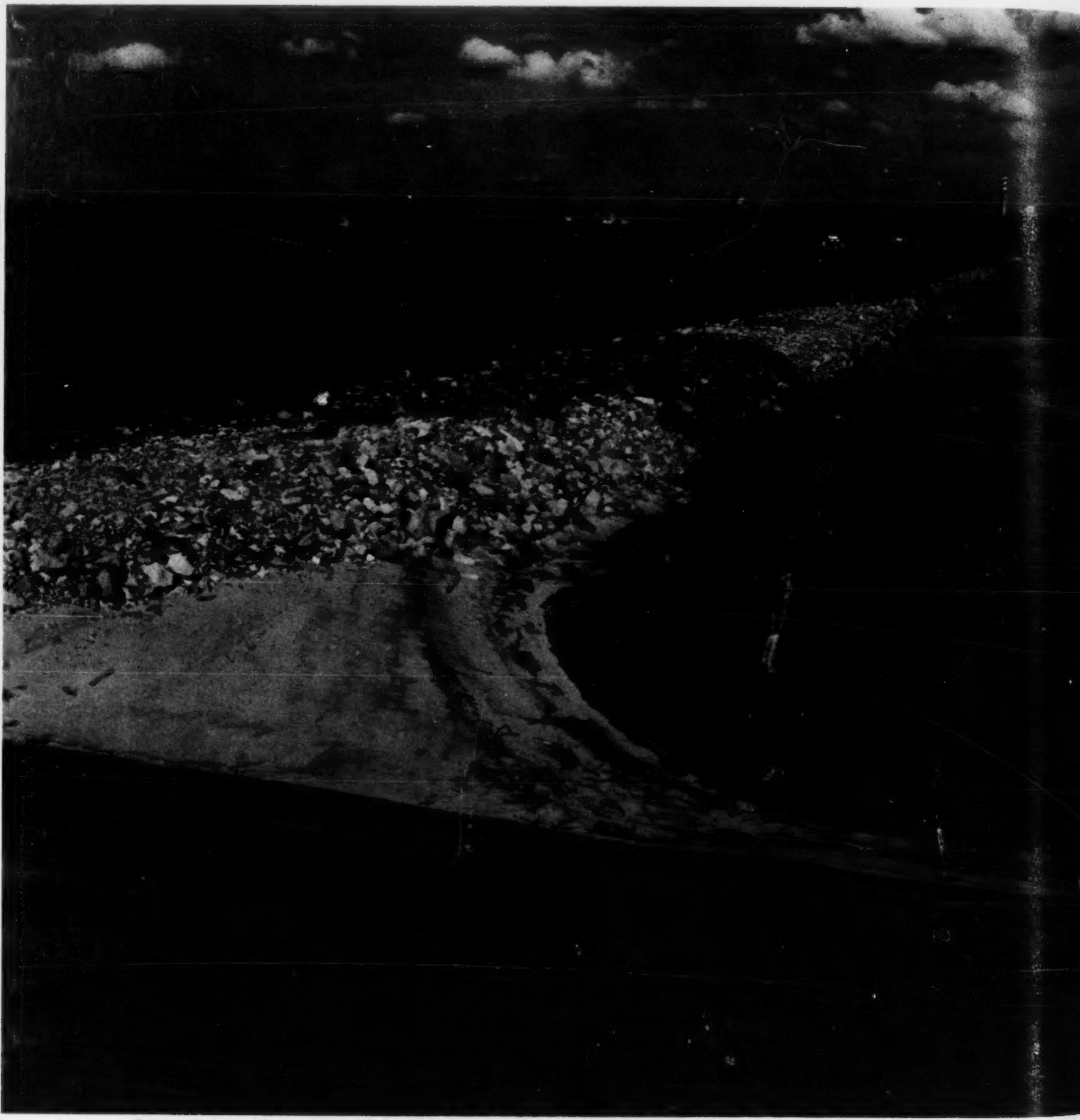
Levee construction by the Memphis District almost halted in 1958 as only about 2.5 million cubic yards of material was added to the levees. Late that year, final contracts were awarded for the last items in the Memphis flood control plan on Wolf River and Nonconnah Creek. This construction consisted of 3,900 feet of floodwall and 630 feet of levee between Willett and University Streets along Chelsea Avenue. Because of a five year delay from 1942 to 1947, the project had now taken two decades to complete. In May, 1958, Memphis Engineer District began the construction of the Ensley Bottoms portion of the Memphis harbor project. Consisting of eleven miles of levee and a pumping station, the project would provide approximately 7,000 acres of additional industrial sites, now called the Frank C. Pidgeon Industrial Area, and a home for the floating plant and repair shop of the Memphis District.

Almost yearly, the Mississippi River Commission had to conduct a campaign to get the necessary funds to carry out its flood control and navigation projects. During most of the decade of the 1950's, a pattern of Congressional approval and White House opposition had developed and the same was true in 1959. Congress passed a bill which provided funds for the diversion of Wolf River plus several other projects in the South. However, for the very first time, Congress mustered enough votes to override a presidential veto. At first, the White House decided it would impound the funds just voted by Congress, but intense pressure forced the President to yield to Congressional wishes.

With these funds, the Memphis Engineer District carried out its flood control work at about the same rate as in previous years. Levee construction amounted to almost eight million cubic yards. On the St. Francis River project, 198 miles of levee and 18.5 miles of channel improvement were completed. Work on the White River backwater levee was about 99 percent complete, and the Madison-Marianna floodway was considered complete except for the removal of an earth plug which had prevented continuous flow through the channel during construction.[79]

During 1959, the Memphis District expended approximately $24 million on flood control and navigation works and it had given work to almost 2,000 employees. The District was maintaining a fleet valued at $40 million. Since the Flood Control Act of 1928 had become law, the Memphis District had expended approximately $350 million on flood control and navigation works.[80] The romantic era of muscle and mud had long passed, but there was still much work to be done.

A pile dike designed to seal off a growing secondary chute near Lookout, Tenn-Ark. November 30, 1959.



Riprap being added to raise the height of a wing dam, or dike. Towards the outer reaches of the dike can be seen the protruding remains of a previous pile dike.

CHAPTER X

Rolling on: 1960-1976

The first levees along the Mississippi River had been completed at New Orleans in 1727. From that one-mile beginning, the levee line had grown to a whopping 1,706 miles. By 1960 commodities shipped on the Mississippi River amounted to more than 112 million tons, and water transportation across the nation was being projected to double by 1980 and to redouble by the year 2000.[1] Increased water traffic on the inland rivers presented a major problem for the Corps of Engineers, particularly on the Mississippi.

The Memphis Engineer District both expected and received a major role in providing an adequate channel for river commerce, because the District included one of the most troublesome stretches of the river and because a good share of the revetment work carried on by the Mississippi River Commission was located within the Memphis District. Practically all of the dredging work in the Mississippi was between Cairo, Illinois and Helena, Arkansas, also under the jurisdiction of the Memphis office. Of the more than 39 million cubic yards of material dredged from the main-stem channel, in 1960 approximately 35 million cubic yards came out of the Memphis District.[2] Revetment construction that year consisted of placing more than 48,000 linear feet of new work and approximately 14,000 linear feet of repairs to old bank protections. As a part of the channel stabilization program, 20,500 linear feet of new dikes were constructed.[3]

A majority of the flood control work was devoted to Memphis and to the St. Francis River project. With the completion of section five of the flood control plan for Memphis, the project that had been adopted in 1937 was finished. The flood control project along Wolf River and Nonconnah Creek had cost more than $11 million.[4] Work on the diversion of Wolf River into Loosahatchie Chute was initiated, and at the Ensley Bottoms, the levee to protect the new industrial site was 41 percent complete.

The Memphis Engineer District added only 4.3 million cubic yards to the levees in the District and, other than these levees, the St. Francis project was the recipient of most of the flood control work. Work was completed on the Madison to Marianna floodway channel and on several of the bridges that crossed it. A part of the project was the Round Pond and Grassy Lake drainage canals near Round Pond and Duvall, Arkansas. Approximately 12 million cubic yards of material was excavated from the two canals.[5] Completed levees on the St. Francis River now totaled 206 miles. On the St. Francis below Riverfront, Arkansas 19 miles of channel improvements and cutoffs had been completed by the end of the year.

Since June 1936, when the first legislation was passed to provide for Federal participation in flood control on a nationwide basis, projects increased in both scope and number. By 1961, the 25th anniversary of the legislation, the Corps of Engineers had received authorizations for over 900 projects throughout the nation at an estimated cost of $9 billion, but less than half of the project funds had been appropriated.

The effectiveness of the flood control structures had brought about public complacency. Since the great floods of 1927 and 1937, a new generation had grown to maturity without experiencing a major flood disaster. The nearest thing to such a great flood had been in 1950, and by comparison, the flood of 1950 was not very great. With the diminished threat, the people moved onto the flood plains in greater numbers and the disaster potential had become ominous should a flood of any magnitude sweep down the Lower Mississippi Valley. According to engineering data, floods causing the loss of 100 lives or more occurred on the average of about once every three years between 1900 and 1940. Since 1940, the frequency of such floods had occured on an average of once in ten years.

Property damage was a different proposition. Floods causing damages of $50 million or more occurred about once every six years between 1900 and 1940. Even with the flood control program, since 1940 floods of this magnitude were now occurring once in less than two years. Flood flows had not increased to any great degree, therefore, the potential damage had to be attributed to further encroachment on the flood plains.[6]

The Corps of Engineers is already planning for the future. It is the contention of the Engineers that – by 1980 – the congress will have to expend an additional $6.5 billion for the construction of projects that might be authorized by 1980 – making the total cost of flood control approximately $11.5 billion. In conjunction with accelerated appropriations, some type of regulation of population movement onto the flood plain will be necessary. Very often industries and citizens have been allowed to locate on the flood plains when adjacent sites were available. Movement to the flood plain often takes place without realizing the potential danger to life and property.

Congress met its responsibilities in 1960 by passing legislation relating to flood plains across the nation. The Corps of Engineers was authorized to compile and disseminate information on floods and flood damage, identifying areas subject to overflow, and to present general criteria for guidance in the use of flood plain areas. Upon request of responsible government bodies or individuals, the Engineers could now furnish engineering advice upon the best use of the flood plains. No funds to implement the program were immediately available, but – in 1961 – the Engineers began to accept applications because funds would become available during fiscal 1962.

By the end of fiscal 1961, the project for flood control and navigation on the Mississippi was 65 percent complete. Levee construction in the Memphis District during 1961 amounted to approximately 6.4 million cubic yards. In the Memphis District, there were more than 1,185 miles of main line and tributary levees and, of this total, 94 percent was complete to grade and section.[7]

The Flood Control Act of 1960 authorized an additional $50 million to be expended on the channel stabilization program for the Lower Mississippi River.[8] During 1961, crews constructed 23 miles of new revetment and approximately 61,000 linear feet of that new revetment and reinforcement was constructed by the Memphis District. Eleven thousand linear feet of revetment was placed near Memphis in anticipation of the construction of a new Interstate highway bridge across the river. But stabilizing this Memphis reach became more difficult than expected. The District Engineer told a group of visiting Congressmen that the project was taking longer than contemplated and that the new bridge would be completed later than predicted.[9] Dike construction during the year was approximately 21,000 linear feet.

In 1961, the Memphis District excavated more than 12 million cubic yards to improve the channels of the Mississippi tributaries, with most of the excavating taking place on the St. Francis River. The remaining channel improvements were confined to the Obion and Wolf Rivers. On the St. Francis project, the Round Pond and Grassy Lake drainage canals were completed except for the removal of earth plugs. The removal of the plugs were awaiting the completion of several bridges across the channels.[10]

In late 1959, bids were invited for the construction of an ultra-modern, twin-screw diesel towboat to replace the steamer MISSISSIPPI. The new boat, the fourth to bear the name MISSISSIPPI, was 217 feet long and 48 feet wide. In early January, 1960, the Engineers awarded a $1.5 million contract for the construction of the towboat. MISSISSIPPI IV made its first trial runs in March, 1961, and was anything but a success. The major fault was a nerve-shattering vibration, but – at the time – it was attributed to the light fuel load and ballast the boat was carrying.

In early April, 1961, MISSISSIPPI IV began to make its way toward Memphis where it would be accepted by the Engineers.

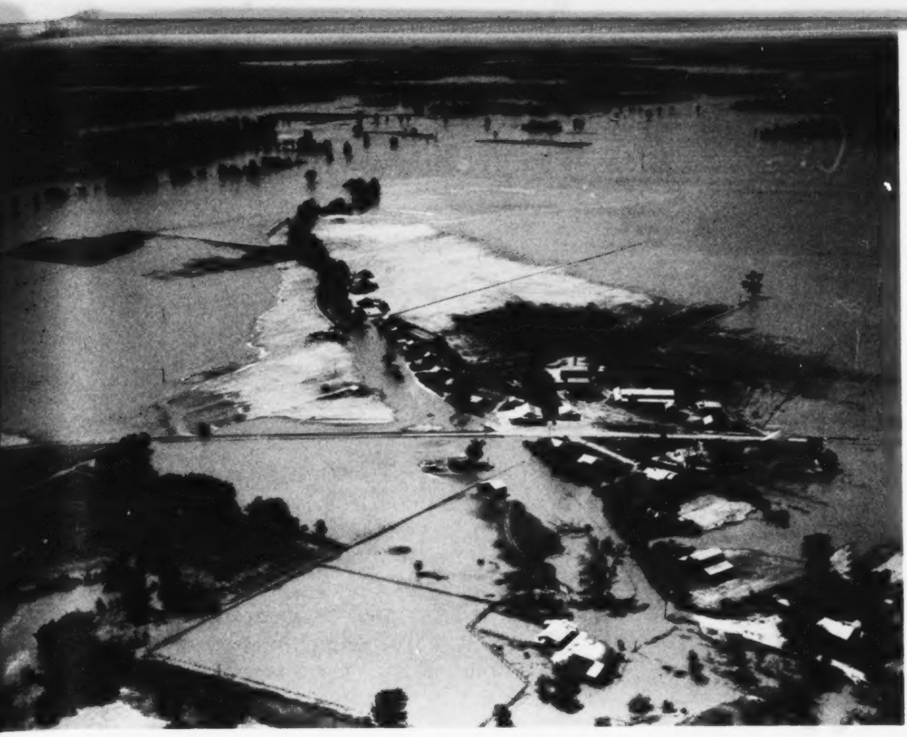
The official Inspection Ship of the Mississippi River Commission, the Motor Vessel "Mississippi" is also the workhorse of the Memphis District.

Workers at the Ensley Engineer Yard lined the piers to greet the new Texas-deck towboat.[11] But the Engineers only provisionally accepted the boat because – on its maiden voyage – the excessive vibration on the stern had caused welding to give way between steel hull plates and a supporting beam. Because of the broken weld, one of the engines had to be operated at a reduced speed. On April 19, 1961, the old MISSISSIPPI III was decommissioned and the new towboat went into service in the dual role of working towboat and official inspection boat for the Mississippi River Commission.[12]

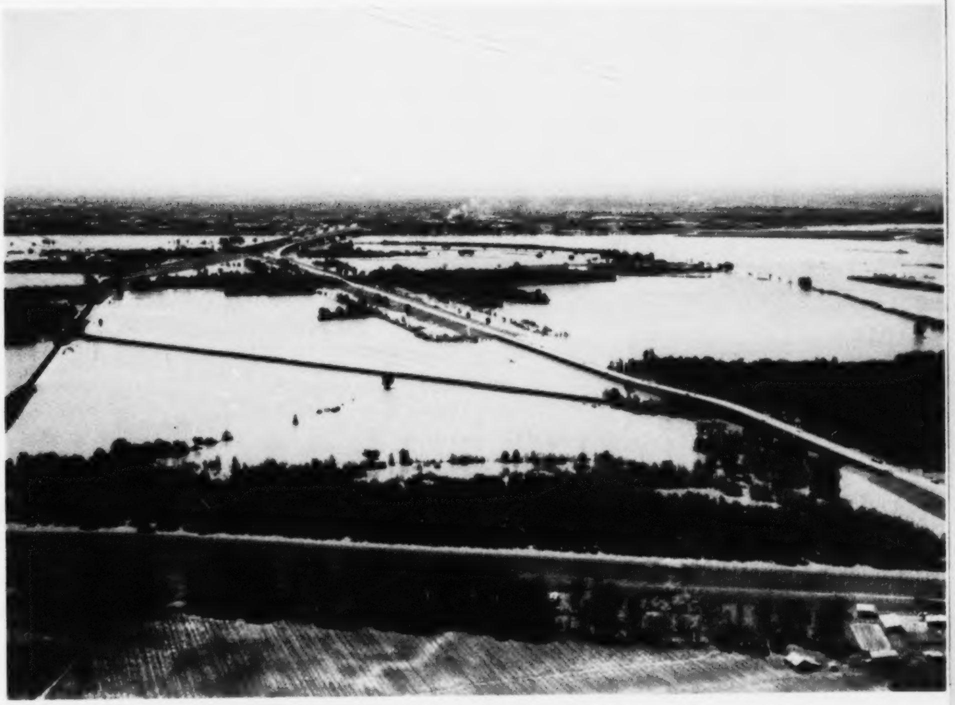
Although the towboat was conditionally accepted, the vibration continued to be so great that it could not be used to push the full design tow of barges. In September 1961, a staff member of the Netherlands Towing Tank in Wageningen, Holland, came to Memphis to see if a solution to the vibration could be found. They had previously been involved as the company conducting the pre-construction tests. Unsatisfied with the results, the Engineers asked Dr. Frank Lewis of the Massachusetts Institute of Technology to have a look at the problem.[13] In late 1961, approximately 22 tons of steel plate was welded to the vessel's frame in an attempt to eliminate or at least reduce vibration. The additional steel did reduce the trouble, but did not eliminate it. In fact, the added weight created another problem in braking the boat. In another attempt, new propellor blades were added. These greatly helped the problem but some vibration still continued. "Captain Jack" Russell fought it until his retirement in 1973, and even though the vibration is now considered to be well within tolerable limits, the battle is still being waged.

In February 1961, the Mississippi River at Memphis began a slow rise to a stage of 36 feet on the Weather Bureau gage. After a slight drop, the river began another rise culminating in a stage of 40.18 on May 22nd.[14] Such stages posed no great problem for the government levees, but, as the water rose, many substandard private levees would be taxed to the utmost to hold back such a river stage. When the second rise in the river began, the Engineers warned residents in the St. Francis Basin to prepare for backwater flooding and to begin Phase I of the flood fighting operation. Under this plan, Engineer employees work with local officials in checking flood control structures and in observing developments.

By mid-May, the river had forced the closing of the Missouri ferries at Cottonwood Point, Caruthersville and Portageville. The overflow had driven approximately 400 persons from their homes in West Tennessee and the Weather Bureau was reporting that about 520,000 acres were flooded between Caruthersville, Missouri and Helena, Arkansas.[15] A small airport on Mud Island at Memphis was forced to suspend operation because the runway was covered by three feet of water and Riverside Drive, along the river front, closed when the water came within inches of overflowing the street at a low place between Beale and Georgia Streets. City Engineer, Will Fowler, reported that the flood control plan for Memphis, which had been completed only a few years before, had prevented two feet of backwater from accumulating in the lobby of the Peabody Hotel.



Flood of 1961. Looking East from River Mile 800 toward Ashport, Tenn.



Flood of 1961. View looking East toward Memphis, from West Memphis, Ark.

The flood of 1961 occurred relatively late in the planting season and the agricultural losses were high in unprotected areas. Along the Mississippi River and its tributaries, backwater inundated 2.6 million acres, of which 500,000 were croplands. Farmland was inundated to depths varying up to 13 feet, and crop losses were estimated to be $12 million. Property losses were placed at $2 million, excluding the damages caused by tributary flooding. It was estimated that if the flood of 1961 had been unconfined, the damages would have been approximately $700 million.[16]

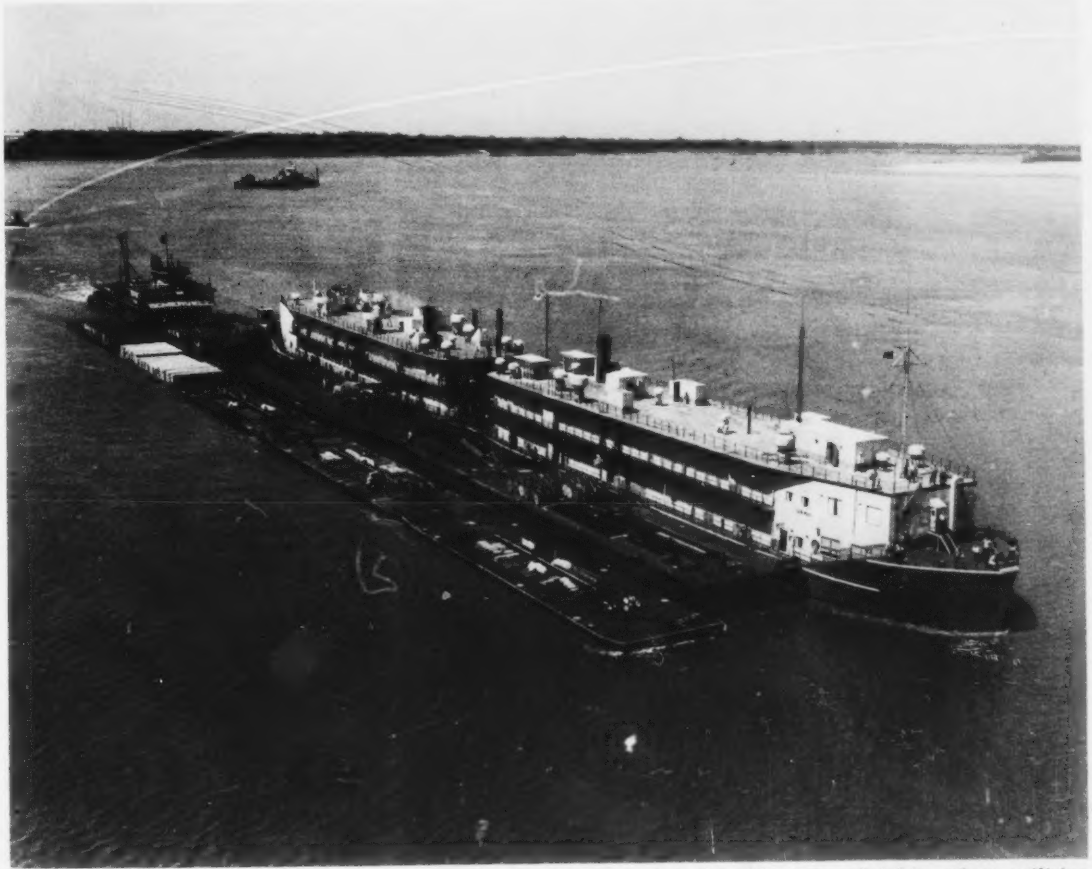
After the flood of 1961, Colonel Marvin L. Jacobs, District Engineer, pointed out that many of those who participated in the flood fight were beyond the age of 60, and therefore, were unable to conduct a spirited flood fight. Colonel Jacobs said that the lack of young, trained flood fighters was a serious problem, and the District office was ready to make its training program available any time a group was willing to attend. Sterling Price Reynolds, the 100-year old "dean of the flood fighters" and chief engineer of the St. Francis Levee District of Missouri, countered with the observation that when a flood fight was necessary he always called on the prominent men, because they would be hurt the most if a levee broke.[17]

More than half of the funds allotted to the Memphis District, exclusive of channel improvement on the Mississippi, was devoted to the St. Francis River project. Work on the Tulot Channel, involving a total excavation of approximately 4.4 million cubic yards, was finished and the excavation of St. Francis Bayou, involving about 2.6 million cubic yards, was 82 percent complete. Contracts for Wittsburg cutoffs and for excavation of Big Slough Ditch were awarded. More than 1.5 million cubic yards of earth was added to the levees on the St. Francis, and at the end of the fiscal year, 235 miles of levees were complete to grade and section.[18]

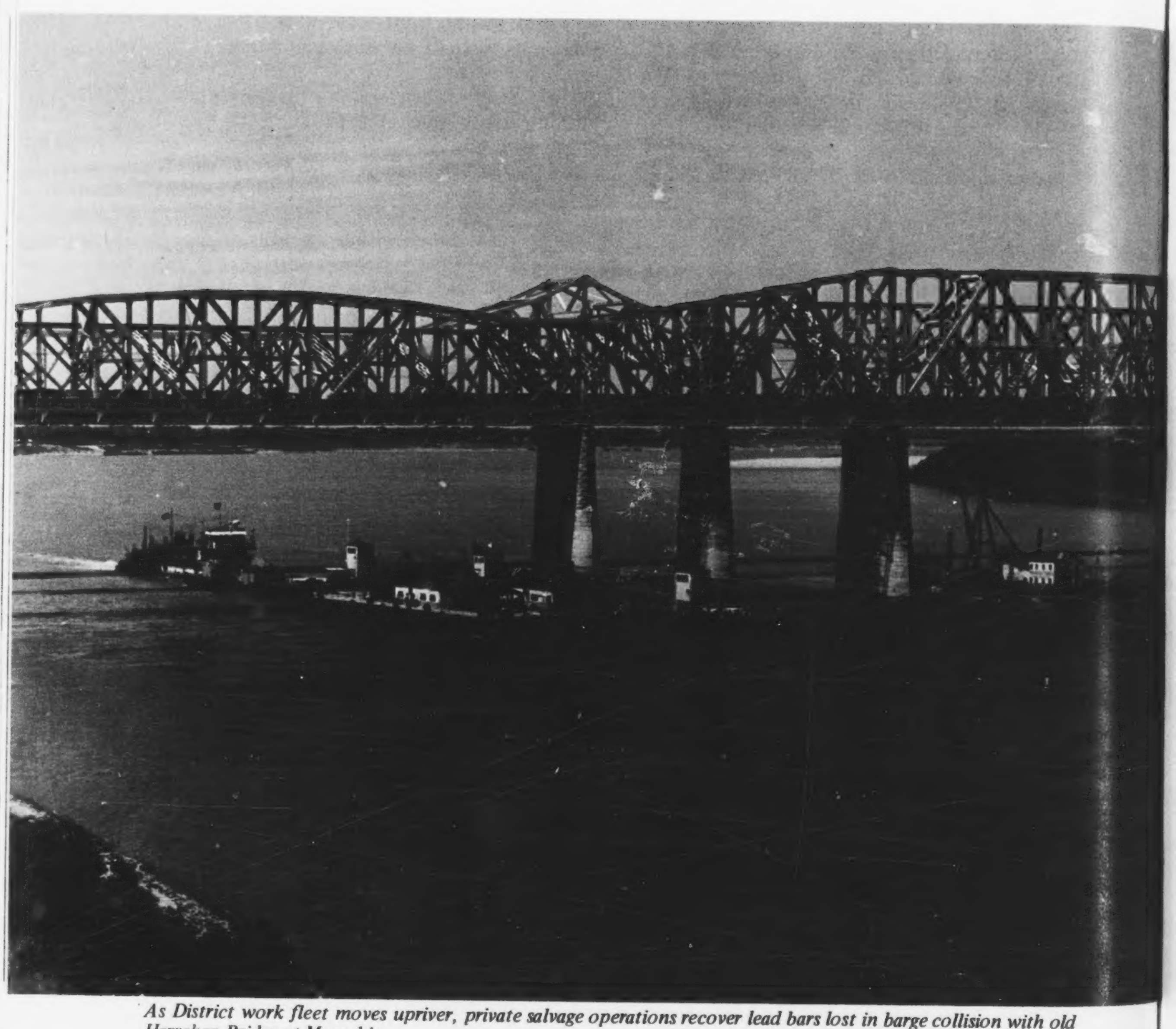
Levee construction continued at about the same pace as in previous years, but revetment construction was on the wane. Approximately four million cubic yards of material was added to the main line levees. Replacement of old revetment about equaled the amount of the new revetment construction. Approximately 29,000 linear feet of new bank protection was constructed, but replacements amounted to about 26,000 linear feet. During 1962, the Memphis District constructed approximately 12,000 feet of dikes. At the end of fiscal 1962, the effective revetment work in Memphis District was about 1.3 million linear feet, and dikes that were operative totaled about 112,000 linear feet.[19]

Winter barge traffic on the upper Mississippi River is often halted because of ice jams. In 1962, hundreds of barges were tied up at Cairo awaiting the seasonal break up. One of the barges broke from its mooring setting off a chain reaction as it hit other barges. An estimated 175 of the barges were eventually snapped loose and began wandering down the river – banging against bridge piers and river terminals. By nightfall, about 90 percent of the barges had been retrieved – some of them from as far downstream as 70 miles.[20]

When the Mississippi River reaches flood stage, the velocity of the current makes the job of a towboat pilot very dangerous. On March 13, 1962, the current crushed a barge tow into a pier of the old Harahan Bridge. As the barge went down, it carried with it a valuable shipment of lead. The lead was cast in 2,000 pound ingots valued at $190 each. Salvage operations began almost immediately, and, after several months of work, 1,384 of the ingots were recovered by divers. Only 18 of the ingots were unrecovered and left buried in the sand.[21]



Work fleet proceeding upstream in two tows. In the background is the older type of sinking plant, utilizing cranes for placement of the articulated concrete mats. In the foreground the Somervell two includes two quartering boats and a dock barge, as well as several barges of work material, including one barge of mats. July 26, 1962.



As District work fleet moves upriver, private salvage operations recover lead bars lost in barge collision with old Harrahan Bridge at Memphis.

While a two or three foot rise per day in the Mississippi River is noteworthy, anything above such a rise is unusual. In a twenty-four hour period in 1963, the Mississippi at Memphis rose 6.2 feet. To demonstrate the seriousness of the rise, it should be noted that a one-foot rise indicates an additional flowage of 220,000 gallons of water each second at any given point. Thus, the 6.2 foot rise in the river meant an increase of 4.91 billion gallons of water flowing past Memphis every hour.[22]

In contrast to this phenomena, the river was below the zero stage for most of the last three months of 1963. Ice will form more easily when the river is in such a low stage, and ice can frequently be found as far south as Memphis. By December 1963, the Mississippi was three-quarters choked with ice for thirty miles below Memphis. The District Engineer had to order the patrol boats and dredges out of the river and into McKellar Lake to protect them from the ice jams.[23]

During 1963, the Memphis District placed approximately 5.2 million cubic yards of dirt on the levees and more than half of this total was confined to the levees on the St. Francis River. When finished, this levee system was planned to be more than 356 miles long and, as of June 30, 1963, 251 miles, or 67 percent, of the levees were complete. Ten miles of the levee protecting the Ensley Bottoms portion of the Memphis Harbor project were finished, and the entire project was approximately 84 percent complete.[24]

Work on the excavation and improvement of various channels within the engineer district was receiving more attention than in

The burlap bag is not yet phased out despite experiments with nylon bags.

previous years. More than 14 million cubic yards of material was excavated from the Obion, Wolf and St. Francis Rivers. Work on the Wittsburg cutoffs, St. Francis Bay and Big Lake Floodway, all a part of the St. Francis project, was completed.

Eager officials of both the city of Memphis and the surrounding municipalities began to put pressure on the Engineers to speed up the stabilization of the river at Memphis so that construction of the new bridge could commence. The Memphis District had to get the river into a fixed channel before a permit could be issued to start construction of the bridge. In the Memphis reach of the river, more than 32,000 linear feet of revetment and approximately 45,000 linear feet of dikes, were constructed during the year.[25] Throughout the District, revetment was placed at 42 locations. The material included enough concrete to build a 102-mile highway 25 feet wide and nine inches thick.

The year 1963, closed with another major relocation of the District Headquarters. The old facilities across the river near West Memphis had served the District well since they were established in 1932, but the Repair Depot had become isolated from the river by a sandbar which even annual dredging could not combat. Since the Engineer Yard had been forced to relocate on the Tennessee side in the Pidgeon Industrial Development area of the Memphis Harbor, it no longer made sense to have the administrative and technical offices isolated at West Memphis. In 1963, when the new Clifford Davis Federal Office Building was completed in downtown Memphis, the Corps was quick to relocate to the new and modern facility. On November 1, 1963, the initial phase of the transfer was completed, and – in time – the District Headquarters would be comfortably housed primarily in the 5th, 6th, and 7th floors, where it remains. The infamous spittons survived the transfer, although now they were reduced in number and discreetly hidden in desk drawers. The old headquarters at West Memphis was turned over to the General Service Administration, and the GSA in turn leased it to the city of West Memphis and it was sold later.

As of January 1964, the cost of flood control in the Lower Mississippi Valley totaled about $1.5 billion. Damages prevented by the flood control were were estimated to be about $7.2 billion, and thus the benefit as compared to cost showed more than six dollars for each dollar invested. Flood control work in the Valley had assured its people a high degree of protection, but additional work still needed to be done. The Weather Bureau reported that – across the nation between 1925 and 1961 – an average of 75,000 people were forced from their homes each year by floods. Floods had killed an average of 81 each year, and the nation had sustained more than $177 million in damages each of those years.[26]

The comprehensive report on flood control work in the Lower Mississippi Valley, which had been called for in 1954, was finally published in 1964. In the Memphis District, it was recommended that several projects be modified. The review report suggested that the project in the Cairo area be modified to provide a pumping station for the Cottonwood Slough area of the Cairo Drainage District, and another pumping station at the Cache River. Including an outlet ditch for Mound City, Illinois, the estimated cost of the modification was placed at $580,000.

In the New Madrid area, the purpose of the review report was flood control and drainage problems in the area tributary to the St.

UP UP
BANK BANK

The Memphis District headquarters have been housed in the Clifford David Federal Office Building since 1963.

Johns Bayou Drainage Structure near New Madrid. After a careful and exhaustive study, the Memphis District Engineer recommended that no flood control or drainage improvements in the St. Johns Bayou drainage area be undertaken at this time as indicated in House Document No. 308.[28]

Of all the projects in the Memphis District, the St. Francis River project continued to receive the most attention, with more modifications recommended, than any other project. If all the modifications were adopted in the future, their estimated cost would be approximately $26 million. The District Engineer recommended improvement of the river channel from Wappapello Dam to Crowley's Ridge at the Missouri-Arkansas boundary, including a major cutoff in lieu of constructing an authorized left bank levee. Additional modifications included enlargement of about 30 miles of tributary channels above Crowleys Ridge and about 32 miles of right bank tributaries. Enlargement and cleanout of the Varney River and various other bayous and ditches were recommended. For the area east of the floodways in Arkansas, the review report recommended improvement of 123 miles of tributary streams, with additional improvements in the Little River Basin to cost an estimated $5.3 million. Conservation was an integral part of the review of the St. Francis project. It was recommended by the District Engineer that 13,500 acres be acquired and developed for fish and wildlife purposes. Also, a preserve could be created by plugging the bendway of the old channel near Wilhelmina Cutoff as proposed by the United States Fish and Wildlife Service.[29]

The Memphis Harbor project – in progress since the early part of the 1950's – was about 85 percent complete. In 1964, bids were invited on two sections, a pumping station and levee segment, an action signaling the completion of the Pidgeon Industrial Park and the end of the Memphis Harbor project.[30]

The new harbor at Memphis was created by closing off the secondary channel at the bottom of the picture, and building a road on top of the closure to give access to the port facilities. The view is looking southwest from Memphis, with the main channel of the Mississippi in the background. Entrance to the harbor is kept open by dredging.

Levee and revetment construction in the Memphis District in 1964 was about average. Approximately 6.7 million cubic yards of material was placed on the levees, of which about 5.5 million cubic yards were on the St. Francis River levees. Revetment work, including new work and replacements, was approximately 52,000 linear feet. Channel work on the various tributary streams included excavation of approximately 14 million cubic yards.[31]

Over the years, dike construction had become an important factor in the control of the Mississippi River. Construction of dikes was almost confined to the Memphis District. What work not done by the Memphis office was being carried on by the Vicksburg District. In 1964, more than 27,000 linear feet of dikes were constructed by the Memphis District. At the end of the fiscal year, there were approximately 34 miles of operative dikes in the Memphis District.[32]

As previously noted, since initiating work in the early 1880's the Mississippi River Commission had been using dikes as one means of controlling the Mississippi River. Several types had been developed over the years, and experiments with new types continued in 1964. In the Vicksburg District, there were some experiments with discarded automobiles bodies as material for dike construction. In 1964, 400 old cars were placed along the upstream side of existing dikes to act as screens and produce a more rapid filling of the area. In 1965, more than 600 old cars were stacked three high in a pyramid structure and lashed together with cables. Both of these interesting experiments in dike construction were failures.[33]

The Memphis District conducted experiments with nylon and plastic materials for dike construction. In 1964, nylon and plastic bags were filled with sand and used to replace the stone in a short section of a dike being constructed. The experimental dike was subjected to attack by high river stages above and below the top of the dike. When river stages permitted, the dike was inspected and it was found that almost all of the bags had been ruptured and their contents lost. From these experiments it was concluded that, because of the weakness of the material, they were not suitable for dike construction.[34]

On October 27, 1965, Congress enacted the River and Harbor and Flood Control Act of 1965. This act authorized 150 Corps projects or project modifications having an estimated cost of $2 billion. At the same time, the act increased the monetary authorization for the Mississippi River and Tributaries Project to more than $182 million. The act incorporated those modifications recommended by the River Commission in its comprehensive review of the project published in 1964.

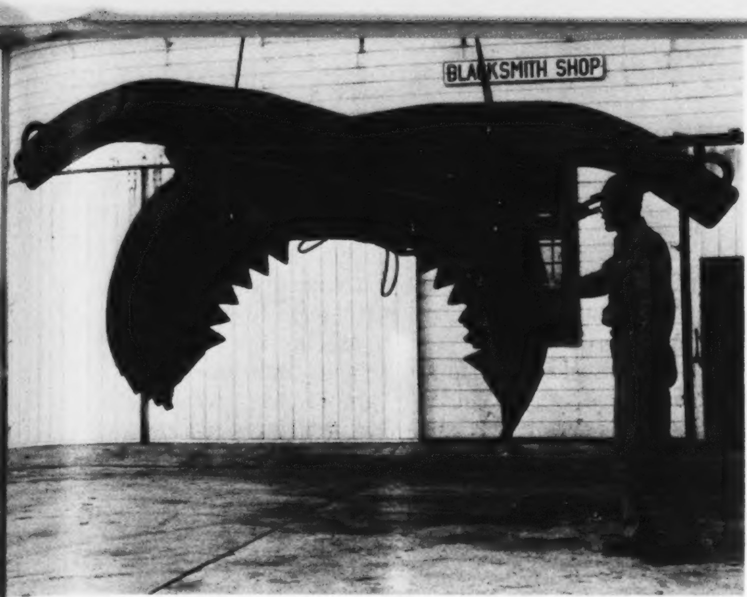
Modification of the Birds Point-New Madrid Floodway was one more aspect of the Flood Control Act of 1965. This modification contemplated increasing the frontline levee to a grade of 62.5 feet on the Cairo gage, excepting the fuse plug areas which were to have a grade of 60 feet. This would provide a higher degree of protection for lands inside the floodway than had been initially considered. The floodway could be placed in use when stages at or above 58 feet on the Cairo gage was reached, and a stage higher than 60 feet was forecast.[35]

In addition to the modifications provided by the Flood Control Act of 1965, a long range master plan for stabilizing the Mississippi between Cairo and Baton Rouge was adopted. The long range plan was designed to guide the river into an efficient channel through a series of actions. Once the desired channel alignment had been achieved, all efforts would be devoted to holding the channel in the preferred position. By the use of contraction works, dredging, and revetment, it was thought that the stabilized channel could be achieved, thus paving the way for the completion of a 12 foot channel depth that had been authorized several years before. When completed, the project would consist of approximately 780 miles of revetment, and 145 miles of that total would be below Baton Rouge.[36]

In March 1965, dredges began eating away at Mud Island to prepare the Mississippi River for the construction of the new interstate highway bridge at Memphis. By the end of 1965, the pilot channel through the island was 67 percent complete, with the removal of approximately 19 million cubic yards of Mud Island. The dredge spoil was placed on another portion of Mud Island, raising the elevation about 20 feet. The additional height would put portions of the land above any known flood stage, and would greatly increase the value of the land. Property that had sold for only $600 an acre thus increased in value to more than $8,000 an acre.[37]

On its low-water inspection of 1965, the Mississippi River Commission received several requests from a succession of Memphis and Shelby County Officials. The Commission was requested to accelerate its program to deepen the channel to 12 feet. Requests were made for additional filling on Mud Island and a flood plain study of both Presidents Island and Mud Island with a view toward their use as park or industrial lands. It was hoped that those requests would receive favorable attention because, for the first time, a Tennessean was serving on the Commission. The Senate had confirmed President Johnson's nomination of Dr. Frederic H. Kellogg, Dean of the School of Engineering at Memphis State University, as a member of the River Commission.[38]

As a part of the effort to stabilize the Mississippi River, in late 1962 the River Commission began a feasibility study of a



Tongs used in snagging operations.

cutoff at New Madrid Bend. The Commission had its eye on the Bessie cutoff ever since the cutoff program ended in 1942. After an investigation, not completed until late 1964, the Memphis District Engineer recommended that no cutoff be constructed at the time and the Chief of Engineers and the River Commission agreed with that decision.[39]

Other parts of the stabilization program were being pushed with vigor. Approximately 47 million cubic yards of material were dredged in the Memphis District during fiscal 1965. Almost half of the material dredged was pursuant to channel construction, because the amount of maintenance dredging was declining. Revetment construction for new work and reinforcement of old totaled approximately 37,000 linear feet. At the end of the fiscal year, the operative revetment in the Memphis District was more than 1.4 million linear feet. In addition, almost 20,000 linear feet of dikes were constructed during the year.[40]

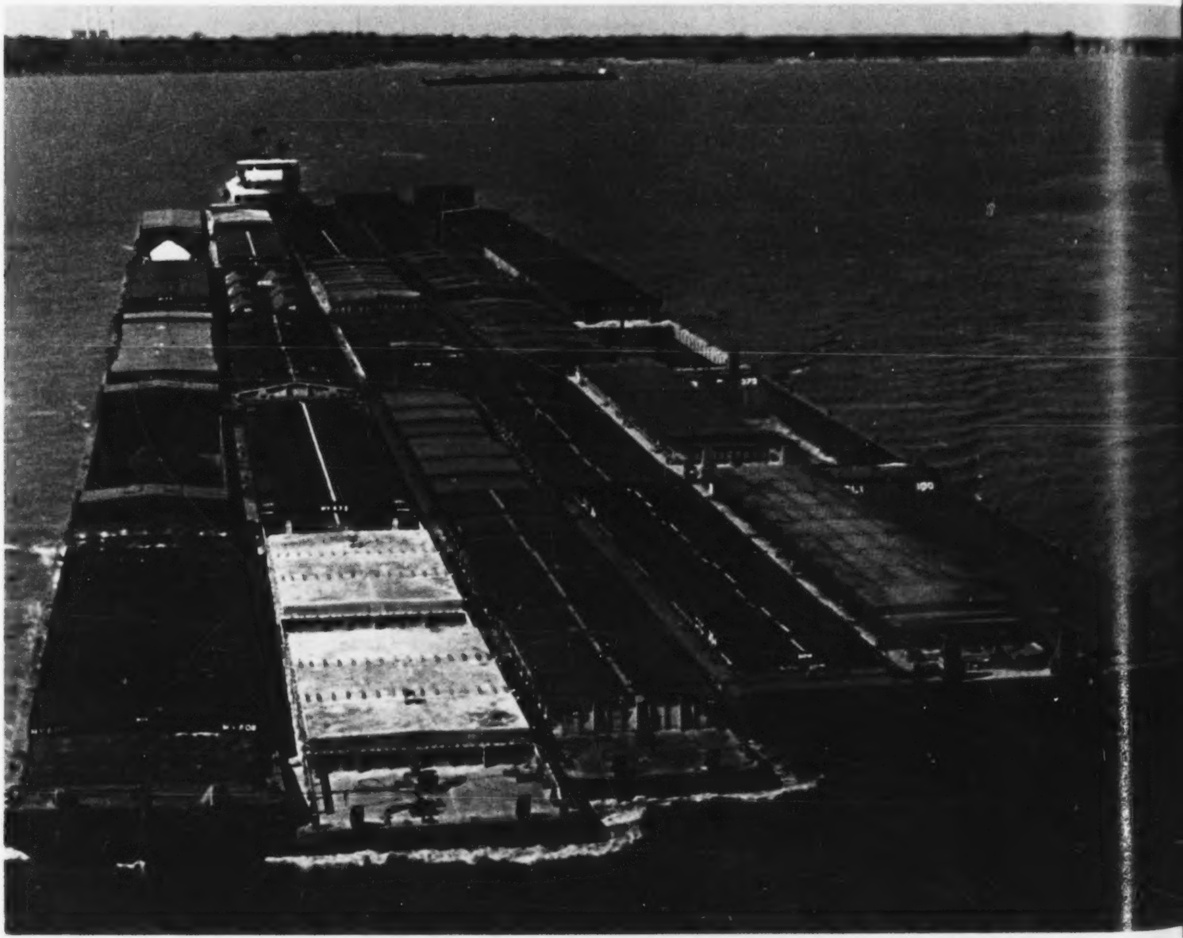
Levee construction during 1965 was confined to the White River backwater levee and the levees on the St. Francis River. Five and one-half miles of backwater levee on the White River was completed to grade and section. On the St. Francis River, 11 miles of levee was completed to grade and section, which brought the aggregated total of completed east and west bank levees to 284 miles. In addition, 64 miles of channel improvement and cutoffs on the lower St. Francis River had been completed. During 1965, eight miles of levee berm and more than 34 miles of road on the levees were completed.

Navigation problems plagued the Memphis District during 1966, resulting in the District expending approximately $6.2 million on dredging. In the early part of February, the Dutch ocean freighter JOMA went aground about ten miles south of McKellar Lake. The Engineers were responsible for maintaining a nine foot channel, but the freighter required a channel about 14 feet deep to operate safely. Colonel James A. Vivian, District Engineer, reported that the boat had been tied up at McKellar Lake awaiting a rise in the river before making its way down the river. The freighter left McKellar Lake against the advice of the District Engineer, and after agrounding, had to ask for assistance to get free. A Memphis District dredge, the POTTER, was sent to aid the JOMA at a rental fee of $231 per hour, but – after several hours of futile work – had to abandon the task. Several times the ship was almost capsized during attempts to move it into a deeper channel, and it was finally decided that only a rise in the river could free the ship.[41]

Navigation channels were becoming more difficult to maintain – even in normal times – because of the ever increasing amount of river traffic. Great tows of new cars intermingled with the usual tows of coal, scrap, iron, grain, and manure. Among the unusual shipments were two tows, one barge carrying

1,200 tons of salad oil valued at $750,000, and the other grain alcohol valued at $4,500,000. Still more fascinating was an open barge of water being pushed upstream; within the barge of water were several serenely moored yachts. It seemed that the owners enjoyed cruising down river but preferred to barge their yachts back to home port. Dangerous cargoes also were commonly found on the river, where transportation was safer than elsewhere. These included liquified methane gas, high octane petroleum products, explosives, and rocket fuel. Some barges were especially constructed to keep their cargoes maintained under extremely high or low temperatures, or – as in the case of anhydrous ammonia – under extreme pressure.[42] Sensitive cargoes were given great care and wide berth, but their presence made a safer, unobstructed and deep channel just that much more imperative.

Navigation on the Mississippi River was hazardous during 1966. On July 1, 1966, the river dropped to three feet on the gage at Memphis and continued to drop during the



Navigation was the first concern of the government, and is still the major concern. No other means of commercial hauling can compare favorably with the tow in terms of economy and bulk.

month. The river reached the zero stage on July 30th and remained near the zero stage until the middle of December.[43] In the early part of August, the District Engineer warned all towboats that the low water period had begun, and urged operators to limit barge loadings to a weight that would afford safe passage through the channel. The Memphis and Shelby County Port Commission asked the Engineers to investigate the possibility of releasing water from dams on the Missouri River to increase the flow of the Mississippi. Even though the river had remained at a low stage for several months, the amount of dredging was about normal for the low water season. At Cedar Point, all traffic was suspended for more than 12 hours because of low water. The dredge **POTTER** had to block what was left of the narrow channel there in order to dredge it to the required dimensions.

Even craft owned by the Engineers had navigation problems. The Motor Vessel **MISSISSIPPI**, the largest of the fleet, struck a submerged object near Lake Providence, Louisiana, and to prevent the boat from sinking, the captain had to run it up onto a sandbar. The boat was safely beached and tied to another Engineers' boat.[44] It was later determined that they probably had struck a submerged anchor, and the impact had ripped a 46 foot gash in the vessel's bottom and flooded several compartments. The **MISSISSIPPI** was repaired at the Ensley Engineer Yard and was back in service in a few weeks.

In 1966, Memphis Engineer District retired its last sternwheel steamboat. The snagboat **ARKANSAS II** had gone into service in 1940. Colonel James A. Vivian, District Engineer, announced plans to install the 300 pound silver-copper bell from the boat in his office at the Federal Building. The bell was 22 inches in diameter and 16 inches high. It had been cast in Cincinnati in 1900 and was used aboard the **ARKANSAS I** before being placed on **ARKANSAS II.** Today, the bell is one of the more interesting conversation pieces at the District office.

In August 1966, the cutterhead dredge **DIESEL** began working away at the plug on the pilot channel through Mud Island. The work signaled the final phase of the stabilization program in the Memphis reach. The island had been subjected to almost round-the-clock dredging since March 1965. An interesting point might be made here that two dredges were used during this period, one each at the upper and lower ends of Mud Island and worked until the two met. Additionally, a stabilization program begun in 1965 was eliminating several of the five crossings between Brandywine Chute and the Memphis bridges. On October 4, 1966, the Engineers had a formal dedication of the new channel. Immediately after the ceremonies, the Coast Guard began placing channel markers and towboats began using the new channel the next day.[45]

In the Memphis District during fiscal 1966, almost 20 million cubic yards of material was moved by dredges in channel construction, most of it on the pilot channel through Mud Island. Regular channel maintenance brought the total figure for Memphis District dredging to more than 50 million cubic yards. In addition, approximately nine million cubic yards of material was moved on the tributaries as part of a program of channel improvement and flood control.[46]

Dike and revetment construction continued to take a majority of the funds allocated to the Memphis District. More than 41,000 linear feet of revetment was constructed as either new revetment or reinforcement of existing revetment. Once again using the highway comparison, if used in building a 25 foot wide highway, the material would be sufficient to build a highway more than 57 miles long. At the end of fiscal 1966, there were more than 278 miles of operative revetment in the Memphis District. Dike construction during the year was approximately 30,000 linear feet.[47]

Levee construction consisted mainly of bringing existing levees up to grade and section. The Ensley Bottom levee of the Memphis Harbor project was completed, and work on the pumping station was being pushed. During the year, 22.8 miles of levee were completed to grade and section and approximately 12 miles of berms and 60 miles of hard surface roads on the levees were constructed.[48]

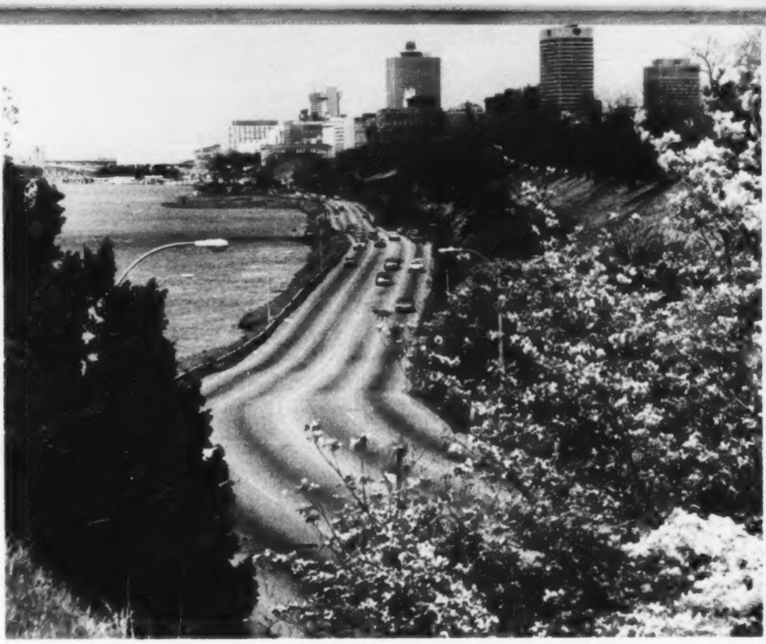
It was reported in 1967 that more than 72 million tons of freight was carried on the Mississippi River between the mouth of the Ohio and Baton Rouge, Louisiana. Corn topped the list of products with nine million tons and was closely followed by gasoline at seven million tons.[49] The Port of Memphis tonnage for 1967 was approximately 7.9 million tons, and it was predicted that – for the next several years – the figures would increase by an average of about eight percent per year. It was the job of the Engineers to provide a channel that would adequately carry such a large volume of traffic.

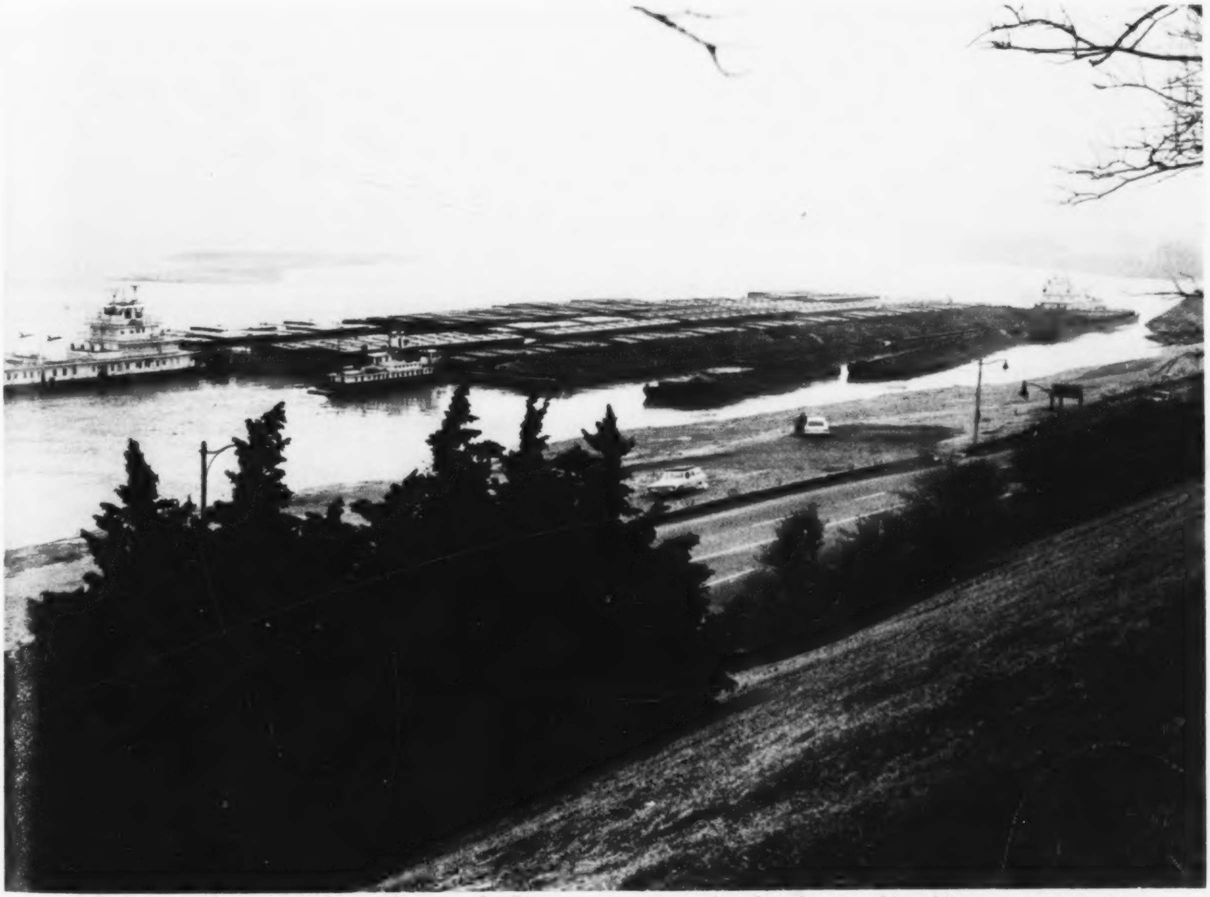
Colonel James A. Vivian, District Engineer, in an interview with a local newspaper, gave his estimate of when many of the various projects would be completed, and the equipment that would be involved in carrying out the work. The Memphis District had approximately 330 pieces of floating equipment with a replacement value of about $44 million. Colonel Vivian reported that a contract for about $5.5 million, as part of a $15-20 million pumping station near the mouth of the St. Francis River, was about to be awarded. If plans went according to schedule, he said, the St. Francis River project would be completed in 1981.

In this interview, Colonel Vivian stated that the West Tennessee tributaries project was approximately 33 percent complete. This project involved 225 miles of channel improvement on the Obion and Forked Deer Rivers, and it was estimated that this project would be completed in 1972. Main stem levee construction was progressing at a satisfactory rate. The Memphis District had the responsibility for levees in parts of six states, and it was hoped that the $106 million program could be completed by 1974. Colonel Vivian could give no firm date for the completion of the $370 million channel improvement program along the Mississippi River.

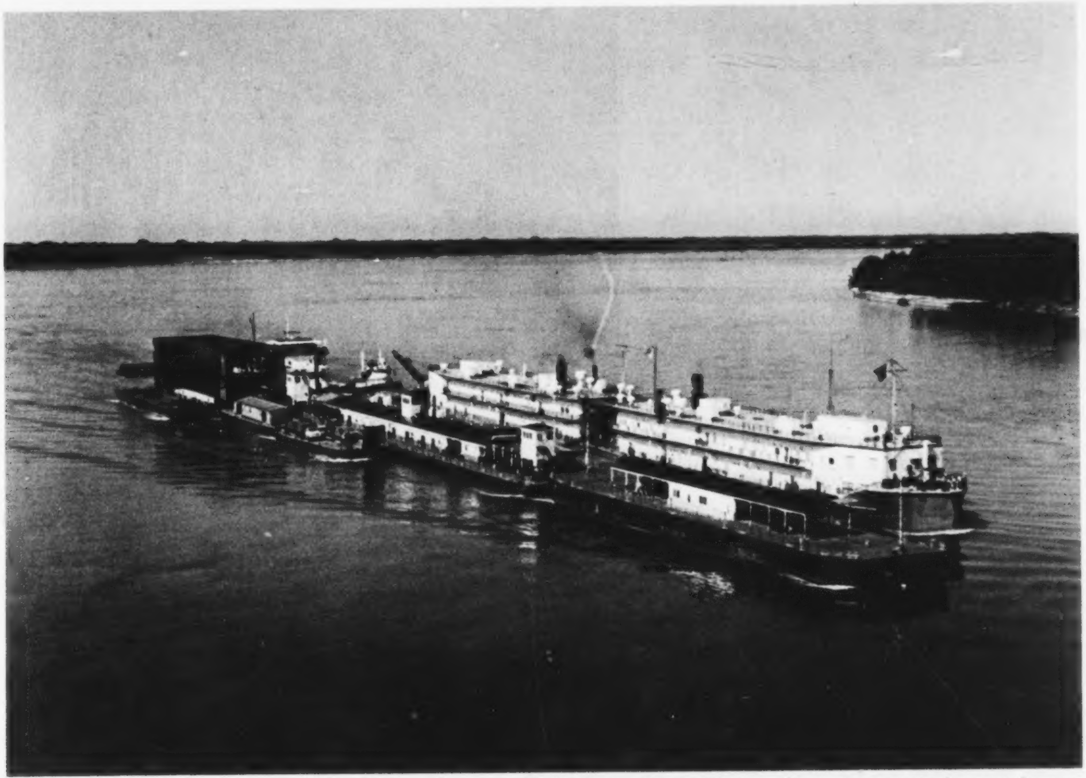
In 1967, the Memphis District undertook one of the heaviest jobs in its history. At the Ensley Yards, the Engineers began the construction of 36 anchors. These were not ordinary anchors – each measured 23x8x5 feet and weighed 56 tons. The Engineers did not have equipment to lift such a device, therefore, the anchors were constructed on barges and then floated downstream. The anchors were part of the Old River Project, a project designed to prevent the capture of the Mississippi River by the Atchafalaya River at a point about 80 miles upstream from Baton Rouge. When finished, the anchors were to be deposited in the river to hold in place a string of five barges serving as a barrier to protect a low sill structure (dam) leading from the Mississippi River to the Atchafalaya River.

Beautiful Riverside Drive at Memphis, during high-water of 1973. John B. Edgar Point is under water, and Tom Lee Park is being encroached upon. Riverside Drive represents the final answer to the caving of the Memphis Bluffs, and was laid over the debris of many previous cavings. Under the modern four-lane thoroughfare lies the ruins of buildings, landings, streets, railroads and even an old steam locomotive.





A frequent and unavoidable accident on the River, a tow aground and in danger of breaking up. At such times any available tugs will be sent to the assistance of the Captain. Here two Warner and Tamble tugs help to free the tow aground on the revetment at Tom Lee Park, Feb. 17, 1967.



Part of the Memphis District work fleet underway. Aside from the mat-lying plant, we see equipment barges, shop and repair barges, and two large Quarter Boats.

The barges, each 235 by 40 feet, were to be pushed downstream and lashed end to end as a 1,175 foot barrier to wayward river tows.[50]

Work performed by the Memphis District was about the same as in previous years. Dredging amounted to about 47 million cubic yards, of which approximately 13 million was in channel construction. Except for minor work on the pumping station and other features, the Memphis Harbor project was almost complete. Revetment construction that year totaled approximately 36,000 linear feet and dike construction was about 61,000 linear feet. Levee construction consisted of completing nine miles of levee to grade and section and approximately 24.5 miles of berms and 8.4 miles of surfaced roads on the levees were completed. Channel excavation on the tributaries of the Mississippi amounted to about 12 million cubic yards.[51]

Funds allocated to the Memphis District dropped by approximately five million dollars in 1968. The reduction in funds was attributed to the fact that the program for stabilizing the Mississippi River in front of Memphis was nearing completion. During fiscal 1968, the Memphis District constructed almost 7,000 linear feet of dikes in the Memphis area. In the effort to hold the channel, 3,560 linear feet of revetment was constructed. Throughout the District, approximately 40,000 linear feet of revetment and about 41,000 linear feet of dikes had been constructed during fiscal 1968.[52]

Channel related works were requiring about two-thirds of the budget of the Memphis Engineer District. Revetment had been placed at 22 locations during the year, and about 1.8 million tons of stone had been used in the construction of 24 dikes. During the dredging season, the dredges worked at 48 jobs at 29 locations. In a normal year, the dredges would move about 25 million cubic yards of material, and they cost about $5,000 a day per dredge to operate. There were several locations in the Memphis District in which the channel gave problems almost yearly. One such location was Cow Island Bend, about 17 miles below Memphis. During 1968, the Memphis District expended approximately $1.5 million in an effort to improve channel conditions at the troublesome location. A 6,000 foot pilot channel was cut through Armstrong Bar and three thousand-eight hundred feet of revetment was placed on the banks to hold it there.[53]

On the Memphis Harbor project, the pumping station and levee were turned over to officials of Memphis and Shelby County for operation and maintenance, thus completing a project that had been underway for almost two decades. Work on the St. Francis River project had progressed to a point where 295 miles of levees were now complete and of 860 miles of channel improvement authorized – 179 had been completed. Other levee construction in the District led to the completion of 6.4 miles of levee to grade and section. The construction of levee berms amounted to 6.5 miles and there were 19.8 miles of hard surface placed on the roads on the levees. Excavation and cleanout of channels of the tributary streams amounted to 34.8 miles. In addition to the above work, flood plain studies for Union City, Dyersburg, Henderson, and Jackson, all in Tennessee, and DeWitt, Arkansas, were completed.[54]

Since 1936, when the Corps of Engineers became the vehicle for a national flood control program, the Engineers had completed almost 650 flood control projects at an estimated cost of $6 billion. During 1968, the Corps was actively engaged in the construction of 149 major flood control projects across the nation. The 900 Corps projects of all categories either then in use or in partial use, prevented flood damages estimated to be $477 million during fiscal 1968.

Operations during 1969 continued at about the level of previous years. Expenditures by the Memphis District amounted to about $28.2 million. Channel improvements continued to be the feature on which most of the funds were expended; the 1969 total was approximately $21 million. Revetment amounted to about 32,000 linear feet of new works and reinforcement of existing bank protection works. Dike construction was approximately 44,000 linear feet. The remainder of the funds were mainly devoted to dredging the main channel. During the low water season, about 35 million cubic yards of material was moved in keeping the channel open for navigation.[55] Other construction during the year consisted of completing 5.9 miles of levee to grade and section; construction of 3.4 miles of berms; and completion of 15.4 miles of surfaced roads on levees.

Floods on the Lower Mississippi were not a major problem in 1969, but the Memphis Engineer District did have some concern about conditions in Eastern Arkansas and on the Upper Mississippi. Week-long rains in Arkansas caused many of the tributary streams to leave their banks. At least seven lives were lost and property damages were estimated to be more than $2.5 million.[56] Flood stages on the Upper Mississippi were one of the highest of the 20th Century, and the floodwaters drove approximately 25,000 persons from their homes, and caused more than $70 million in damages. The Memphis Engineer District sent 13 of its employees from the Construction Division to help fight the flood and their duties included supervision of contracts for the construction of emergency levees.[57]

Lake Wappapello, a beautiful clear-water lake created by the impoundment of the head-waters of the St. Francis River, serves the cause of conservation with the storage of 613,200 acre-feet of fresh water, but it is perhaps best appreciated for its recreational use. With a surface area of 8,400 acres, and a shoreline of over 180 miles, Lake Wappapello is a boating and fishing delight.

In 1970, the environmentalist movement singled out the Corps of Engineers in its efforts to obtain new legislation to preserve the environment. Justice William O. Douglas, a constant supporter of any environmental movement, noted the grand tradition of the Corps, and its autonomous nature, but said that despite the honesty of the Corps they were "inconsiderate of the requirements of conservation and ecology."[58] Lieutenant General F. J. Clarke, Chief of Engineers, defended the civil works activities of the Engineers. He pointed out that the environmentalists were over stating their case and that the Corps had not constructed projects without regard to their effects on the ecology. According to Clarke, the day of letting the Corps work speak for itself was over, and that, hereafter, the Engineers would have to point out the environmental benefits of Corps projects throughout the nation. The Chief of Engineers admitted that mistakes had been made in the past on some projects, "but for every one which has created a problem, hundreds more have created a good which has never existed before."[59]

On January 1, 1970, it was made mandatory that the Corps of Engineers point out both the benefits and the adverse effects of its projects. On that date, all flood control projects of the Corps were brought under the National Environmental Policy Act of 1969. The act required the Corps to issue environmental impact studies on their projects. Each impact study had to include: the environmental impact of the proposed action; any adverse environmental effects which could not be avoided should the proposal be implemented; alternatives to the proposed action; the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity; and any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.[60]

Revetment construction during 1970 amounted to just over 26,000 linear feet of new placement and approximately 10,000 linear feet of reinforcement of existing revetment. Dike construction totaled 53,370 linear feet. In the future, bank protection work could be expanded if conditions permitted. In 1966, the Congress had enacted legislation which provided that revetment could be placed for the protection of existing industrial facilities below Baton Rouge. The Flood Control Act of December 31, 1970, extended the upper limit from Baton Rouge to Cairo.[61]

Improvement of the main channel of the Mississippi had been pushed vigorously since 1928. Revetments, dikes and dredging had produced a relatively stable channel. Dredging in the Memphis District during the early 1950's had averaged approximately 30 million cubic yards each low water season. The channel stabilization program was such a success that dredging in 1970 required the removal of only about 22.5 million cubic yards. Each low water season the dredging fleet had spent part of its time in what was called channel construction. If a crossing in the river caused trouble year after year, the dredges would attempt to guide the river into a new channel by revetment, dikes, or dredging, or a combination of all three. During 1970, the dredging fleet moved approximately 4.6 million cubic yards of material for channel construction.[62] Channel improvements on the tributaries were a related part of dredging, and 7.8 miles of channel excavation was completed during 1970. Since the channel improvement program had begun on the tributaries, more than 146 million cubic yards of material had been excavated.[63]

Levee construction by the Memphis District had almost stopped with only 100 miles or so remaining to be completed to grade and section. In 1970, the District brought only 1.9 miles of levee up to grade and section. Even though the levees could withstand the largest of floods, at the 1970 rate of completion, it would take another 50 years to complete the levees. There were just over 1,180 miles of levees in the Memphis District, with 1,071 miles now complete to grade and section. At the end of the fiscal year 1970, the Memphis District had completed about 204 miles of levee berms and had constructed hard surfaced roads on 536 miles of levee.[64]

The full impact of the ecology movement hit the Corps of Engineers in 1971. Before the year ended, several projects across the nation and in the Memphis District would be subjected to severe criticism. Early in the year, Lieutenant General F. J. Clarke, Chief of Engineers, issued to all districts guidelines on the objectives of the environmental policy of the Corps of Engineers. The objectives were to preserve unique and important ecological, esthetic, and cultural values of our national heritage; to conserve and use wisely the natural resources for the benefit of present and future generations; to enhance, maintain, and restore the natural and manmade environment in terms of its productivity, variety, spaciousness, beauty, and other measures of quality; and to create new opportunities for the American people to use and enjoy their environment.[65] General Clarke pointed out that these guidelines were not designed only to placate the environmentalists and that he intended to see that the objectives were pursued through all three phases of Corps activities – planning, construction and maintenance.

Pollution of navigable waters was one of the focal points of the ecologists. Under the Refuse Act of 1899, the Corps of Engineers was given control of dumping waste into navigable waters. In December 1970, President Nixon issued Executive Order 11574 giving impetus to enforcement of the law and regulations prescribing the permit program were completed in April 1971. A deadline of July 1, 1971, was established for applicants to submit applications with the appropriate Engineer district office. Each applicant was required to submit laboratory data describing constituents of the proposed discharges by October 1, 1971. By the end of the year, approximately 20,000 applications had been received covering about 36,000 discharges, but only 21 permits had been issued. Massive amounts of paper work and a shortage of personnel had made the administration of the permit program very slow.

On December 22, 1971, the District Court for the District of Columbia ruled that the Corps of Engineers had exceeded its legal authority under the Refuse Act by issuing permits for discharges into navigable waters. The court also ruled that the regulations were inconsistent with the National Enviornmental Policy Act of 1969. The Engineers continued to receive applications but stopped short of actually issuing permits. The administration in Washington asked for interim legislation to control discharges until July 1, 1973, at which time it was presumed that the discharge permit authority would be transferred to the Environmental Protection Agency.[66]

Impounding of funds by the Bureau of the Budget in 1971 resulted in the curtailment or halting of work on several projects. Nationwide, the Budget Bureau withheld more than $45 million from the Corps of Engineers.

Funds withheld from the Mississippi River Commission amounted to approximately $4.3 million. In the Memphis District, the resulting curtailment affected work on the Cache River, St. Francis Basin, West Kentucky Tributaries, and projected channel improvements.

Three dredges, the BURGESS, the OCKERSON, and the POTTER, are under the command of the Memphis Engineer District and are used to maintain a nine foot navigation channel. When extended periods of low water occur, the District contracts for additional dredges. In 1971, the Mississippi River dropped to near zero stage, and the three government dredges, although operating 24 hours a day, were not enough to maintain a channel. The dredging fleet moved 27.7 million cubic yards of material during the low water season. Approximately $5 million was spent on all types of dredging during the year.

Maintaining a nine foot channel can be a frustrating job at times. In a matter of hours, the Mississippi River can dump hundreds of tons of silt into a troublesome stretch. Near Caruthersville, Missouri, high water moved a sandbar downstream so fast that a fairly deep channel lost 16 feet of depth in 24 hours. Before a channel could be dredged through the bar, a dozen tows had run aground, including four in just one day.[67]

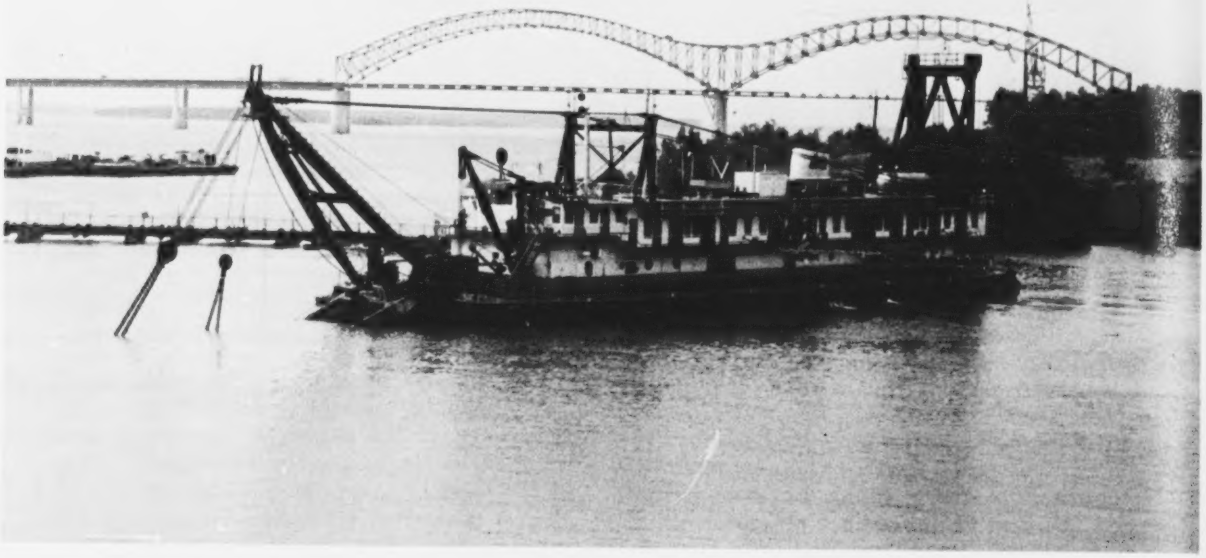
During 1971, the Memphis District placed almost five miles of revetment on the banks of the Mississippi at a cost of approximately $6.1 million. In addition, the channel stabilization program used 1.2 million tons of rock while constructing about seven miles of dikes at a cost of $4.7 million.[68]

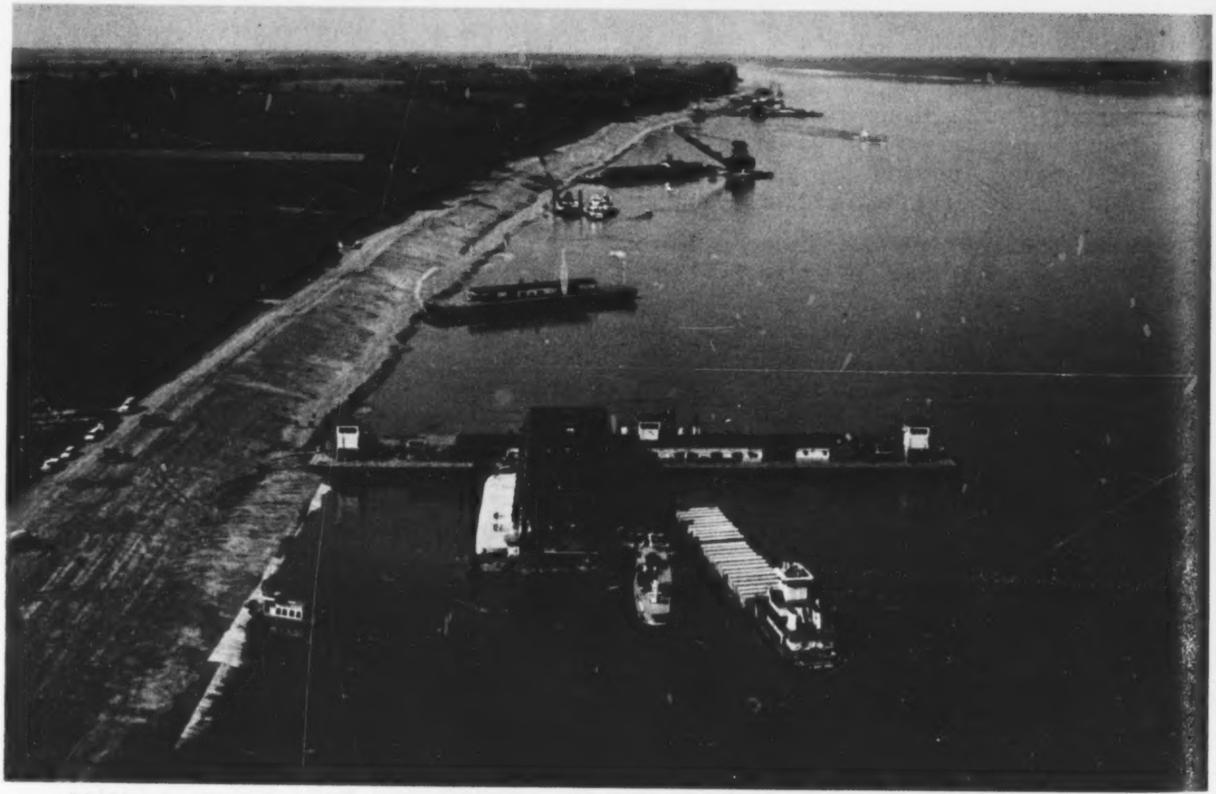
Levee construction in 1971 resulted in the completion of 4.6 miles of levee to grade and section. In completing that year's flood control work, the Memphis Engineer District finished environmental impact studies for the West Tennessee Tributaries project and the Cache River project. Other work resulted in the completion of nine flood plain studies within the District at a cost of more than $215,000.

The Memphis Engineer District began its first work under the aquatic plant control program in 1971. The River and Harbor Act of 1965 had provided that navigable waters be cleared of certain plant life. Included in the list of plants were hyacinth, alligatorweed, Eurasian water milfoil, and other obnoxious plant growths. Such a program was started at the request of the Arkansas State Plant Board and several other district offices of the Corps of Engineers were participating in this program in Arkansas, including the Tulsa, Little Rock, and Vicksburg districts. During 1971, these district offices completed a survey of the state and began to prepare a plan for the eradication of such plants.[69]

In 1971, the Memphis Engineer District began the construction of a project larger than any single construction undertaken previously. As a part of the St. Francis Basin project, contracts were awarded initiating construction of the W. G. Huxtable Pumping Plant, so-named after the longtime chief engineer of the Lower St. Francis Levee District of Arkansas. To be located about 50 miles southwest of Memphis, near Marianna, Arkansas, the $26 million dollar project was designed to pump interior drainage from approximately 2,013 square miles of the St. Francis River Basin over a levee during high water stage of the Mississippi. The area to be drained approximates the total acreage of the State of Delaware.[71]

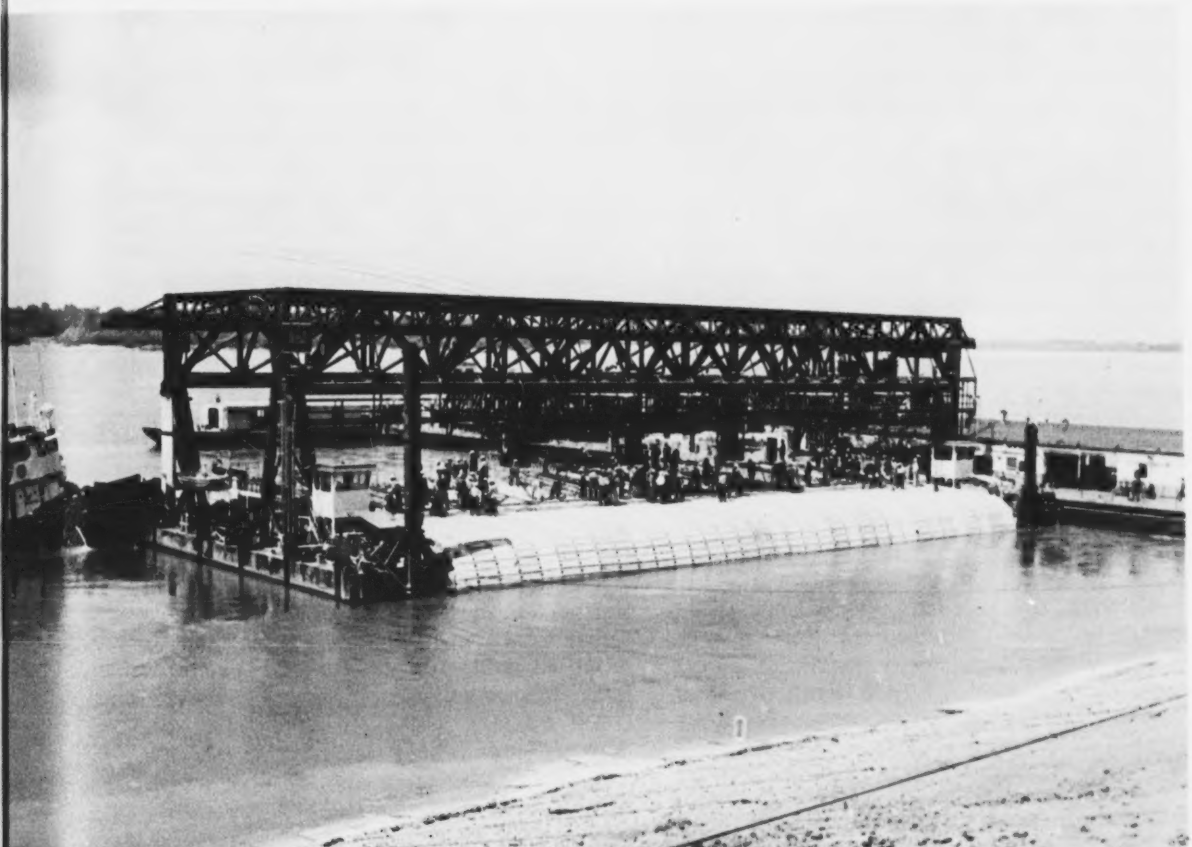
When completed, the plant will consist of ten identical Fairbanks Morse axial-flow variable pitch propeller pumps. Each impeller will be 120-inch o.d., and will be driven by





Working on the levee, today. In the background the banks are being cleared, and at mid-picture the slope is being prepared, A tug is nudging a barge of squares into position on the right side of the sinking plant, while the finished product is being rolled out and sunk to the left of the plant.

The cutterhead dredge "Diesel" removing shoal from the mouth of Wolf River harbor, at the toe of Mud Island. Hernando DeSoto bridge at Memphis was under construction at the time.



The end-result of ever-advancing river technology, the modern mat-sinking plant consists of several tracked overhead cranes which can pick up a section of pre-cast mat (100 square feet), take it to position and lay it on the deck for tieing in the amazing time of 8 seconds. The plant has laid up to 500 squares an hour (50,000 square feet of mat per hour).

Left to right: Capt. J. W. Black, Asst. in Charge; Mr. Paul R. Brown, Supt. of Operations; Mr. Kenneth E. Gilbert, Advisor; Col. G. W. Miller, Dist. Engineer, Memphis Eng. Dist. Also visiting was Mr. Harry Leibovich who operated camera.

separate Fairbanks Morse diesel engines rated at 3,600 horsepower. At full capacity the pumps will be capable of discharging 12,000 cubic feet of water per second, or 5.4 million gallons of water each minute. The very size and weight of such pumps created some special construction problems, for the total weight of the engines and pumps alone came to nearly 2,000,000 pounds, and the construction site was necessarily located in the swamplands. A highly stable structure would have to be constructed on highly unstable terrain.

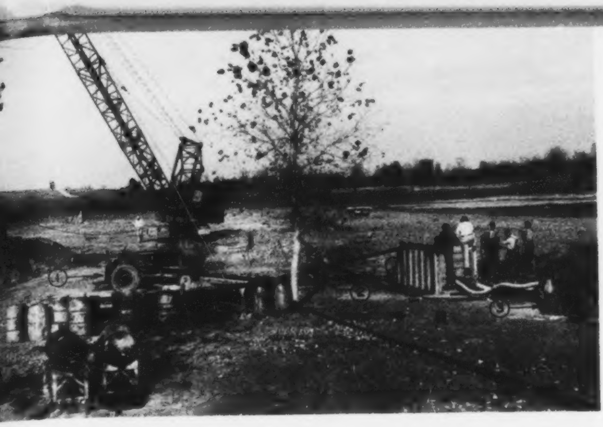
Early in the design of the station, a preliminary dewatering estimate was made based on utilizing a cofferdam and 40 deep wells. The large fluctuations in elevations between flood and low water stages, as much as 70 feet, expected during the construction period dictated that a substantial amount of money be allocated for dewatering. Several individuals felt that this was an opportunity to find a "better way."

Through the District's Value Engineering Programs, several alternatives were investigated. Among these were freezing a cutoff built by the slurry trench method. After careful evaluation of the various systems, the most effective and least costly method was determined to be an impervious cutoff by the slurry trench method that would completely encompass the structural excavation. This method was not new to the District. Some 25 years prior to the design of this station, the District has been given the assignment to find an economical method of effecting a partial cutoff beneath levees for the control of underseepage and piping potential. This investigation resulted in what is commonly referred to in the Memphis District as the "Slurry Trench Experiment."

Placing impervious material into mixing box. Note the discharge of water into the box.

Mr. John W. Black, Jr., then Chief of Foundation and Materials Branch, was in charge of the field operations and development of the technique. The idea for the project probably evolved from the use at that time of puddle trenches for cutoffs under dams combined with the use of drilling fluids for borings. Mr. Black designed and had built a paddle wheel mixing device for making slurry from native clays near the site. Conventional trenching machines of that time were modified and utilized for the excavation. Backfill was mixed in windrows at the site from hauled in clay gravel and native materials and simply pushed into the trench by a bulldozer. It is amazing that after 30 years the technique is still about the same as it was when Mr. Black and his crew were developing it.

Artists' rendition of the W. G. Huxtable Pumping Plant, under construction near Marianna, Arkansas. The plant is designed to remove surplus water from approximately 2,000 square miles of the St. Francis River basin.



View showing equipment used in this experiment. (1) Tractor equipped with belt drive to actuate paddles in mixing box. (2) Mixing box. (3) Circulating and distribution used to circulate and carry slurry to trench, being excavated by dragline.

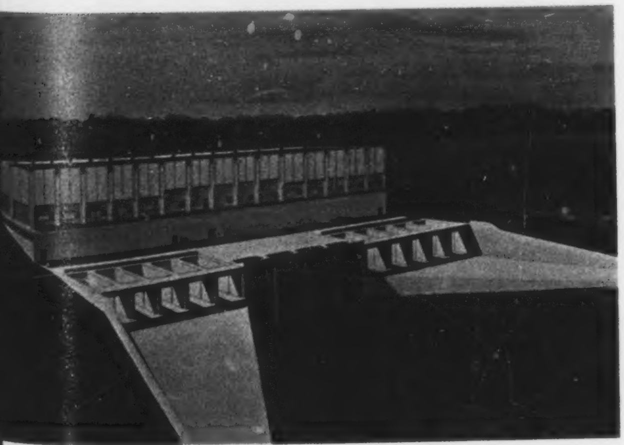
Mr. Black's experiment in September 1945 was the first scale field installation of an impervious cutoff by the slurry trench method. This installation has not been widely known as the first and it is probably due to the title of the article under which its use was publicized. The title was "Deep Cutoff Trench of Puddled Clay for Earth Dam and Levee Protection" by Gen. Hans Kramer published in Engineering News-Record on June 27, 1946. The choice of the term "puddled clay" was probably the reason for obscuring the unique character of what had been developed. Puddled clay was a recognized technique for installing an impervious cutoff at that time. It consisted of opening a cut as deep as possible, usually limited by the sheer strength of the foundation or the water table.

The cutoff was then backfilled by "puddling clay," i.e., mixing water with clay to make mud. Had the term "Slurry Trench" been used in the title, more recognition of this early work would probably have resulted.

An Italian based company, the ICOS Corporation of America, New York, N.Y., was the successful bidder for this project. The construction procedure that they used was a patented process. The ICOS method of digging to the required depth with great augers, drilling the holes at fifteen foot intervals along the line of the trench. Then, as the intervening "plugs" were removed by a specially-designed hydraulic bucket, the space was immediately filled by a slurry mixture of water and bentonite. The slurry mixture would actually fill in the trench as it was being dug, but it would remain in liquid state and act to stabilize the excavation. After the trench was completed, the slurry mixture would be displaced by a heavier and more impervious mixture consisting of hauled gravel, excavated clay, and bentonite slurry blended together to form a homogenous mass.

Since the Huxtable Plant operation was so unique in application of a perimeter cutoff to intercept groundwater, the operation was witnessed and monitored by engineers from all over the world.

After the retainer "wall" was completed, the area was drained, and the 15-acre site was ready for construction. Farrell Construction Company was awarded the contract on a low bid of $22,952,448. The contract specified completion of the project by October 2, 1976, but the massive Flood of 1973 caused the completion date to be "bumped" up to February 1977. The magnitude of the construction operation might be better illustrated by the fact that Farrell has constructed over 9,000 square feet of permanent type steel buildings for offices and warehouse space.



Other than the flood set-back, work is proceeding on schedule and construction is beginning to "come up out of the ground" as of this date, with an estimated 45% completion.

The plan of operation will be to put the pumps into use when the St. Francis River reaches an elevation of 177 feet and the backwater of the Mississippi River exceeds an elevation of 177 feet. The pumps will pump down to a minimum elevation of 175 feet. Should the St. Francis River elevation be higher than that of the Mississippi, four vertical lift-type floodgates will be raised to allow run-off through the pumping plant. Thus the valuable and highly productive farm lands of the St. Francis Valley will be protected from flooding by the St. Francis River or backwater from the Mississippi.[74] The completion of the pumping plant will "close off" the St. Francis levee system.

While the benefits of the Huxtable Pumping Plant were so obvious as to be indisputable, it was not so with other District projects. Ecologists and environmentalists continued their assault. The Corps of Engineers was accused of building for the present, with no concern for future generations.[75] Two projects under construction by the Memphis Engineer District came under heavy attack by the environmentalists – the West Tennessee Tributaries and the Cache River projects.

The West Tennessee Tributaries Project authorized under the Flood Control Act of 30 June 1948, House Document 627/80/2, and amended and modified by Section 207 of the Rivers and Harbors Act of 7 November 1966, Public Law 89-789 and Section 3 of the Water Resources Development Act of 7 March 1974, Public Law 93-251 provides for clearing, clearout, enlargement, and realignment of 225 miles of channels, and acquisition of 32,000 acres of land for the mitigation of fish and wildlife resources, recreation, and environmental purposes.

On 23 April 1970, several individuals filed a civil suit in Federal Court seeking to enjoin continuation of construction of the project. In April 1972, a trial was conducted and on 28 December 1972, the District Court held the procedural requirements of NEPA had not been complied with. On 2 March 1973, the Court enjoined initiation of further construction, allowed completion of relocation work on the Illinois Central Railroad and Item No. 1, Middle City on the North Fork of the Forked Deer River, and directed that a revised environmental impact statement be prepared in accordance with current guidelines. In January 1974, the newly created Obion and Forked Deer Basin authority assumed maintenance responsibility of the West Tennessee Tributaries Project. This responsibility was previously that of the State of Tennessee, Department of Highways and the Department of Agriculture. On 5 August 1974, the District Court entered a consent order modifying the injunction to permit construction on the Mengelwood and diversionary channel items on the lower end of Obion River. At this point, the project was approximately 32 per cent complete.

The final Environmental Impact Statement was submitted to the Council on Environmental Quality on 21 July 1975, and on 2 September 1975 the U. S. Attorney filed a motion for review of the statement, dissolution of the injunction, and dismissal of the case.

The Cache River Basin Flood Control Project in Arkansas had been authorized by the Flood Control Act of 1950, but construction had been postponed in the early fifties due to the Korean War. Subsequently, in the mid to late fifties, all such projects were reviewed and public hearings held. This review resulted in confirmation of the need for flood control in the Cache River and Bayou Deview Basin, and in 1962 Congress appropriated $100,000 with which to commence preconstruction planning. However, by this time some opposition had developed, primarily from wildlife interests. Congress directed the Corps to make a special study of the downstream reach of the project area. This study was completed in late 1963 and a report sent to Congress in 1964. Conclusions of the report were that the Cache Project would have no appreciable effect on agricultural or timber lands along the extreme lower reach of Cache River and along the White River downstream. Preconstruction planning was recommended in early 1966 and in July of 1969 the general design memorandum for the project was completed.

By the Fall of 1970, the District had detailed plans ready for the initial construction (covering the lower 7 miles of a total of 231 miles of planned channel improvement), local interests had acquired all the necessary rights-of-way for the item, and advertisement for bids from contractors was scheduled for December of 1970. However, about this time the Corps completed its first environmental impact statement covering the project, as required by the National Environmental Policy Act of 1969. Although there had been growing emphasis on environmental aspects of the work, this statement set forth the potential adverse environmental impacts so clearly that the Corps of Engineers decided to delay initiation of construction pending further study. Local interests had been actively pushing for work on the project to begin – primarily through the efforts of Mr. Jim Denton of Newport, Arkansas, the action man of the local sponsoring agency, the Cache River – Bayou Deview Improvement District. However, these local interests, too, could see a need for additional study of environmental aspects of the project and agreed to the delay. The United States Fish and Wildlife Service and Arkansas Game and Fish Commission were requested to provide recommendations for modifying the plan to provide measures to ameliorate or mitigate environmental losses. These agencies recommended acquisition of 28,900 acres of Wildlife land and installation of several water control structures for fishery and waterfowl management. The Corps of Engineers upped the proposed acreage to 30,000, concurred in the need for the structures and recommended to the Congress that the project be so modified. In the meantime the wildlife agencies had second thoughts and decided their original plan for purchasing the 28,900 acres would not provide sufficient mitigation and the acreage should be 70,000.

These efforts to provide fish and wildlife conservation measures resulted in public focus on the project and environmental interests mounted an attack. On 6 October 1971, the Environmental Defense Fund and others filed a civil suit in the Federal District Court at Little Rock, Arkansas, aimed at enjoining Construction. The primary allegation of plaintiffs was that the environmental impact statement was inadequate. The Corps had rescheduled initiation of construction for late Fall of 1971 but again voluntarily postponed starting, pending resolution of the lawsuit. In May of 1972, a Court hearing was held. The Court ruled the impact statement was adequate. Later that month, bids were opened for the first item of work. A contract was awarded and the contractor worked from July to the fourth of December, 1972, when he was stopped by high water.

Plaintiffs in the lawsuit had appealed the District Court decision and on 14 December 1972 the appeals Court reversed the District Court and ruled the Corps must revise the impact statement. Subsequently, in March of 1973, the District Court issued an injunction prohibiting further construction pending preparation and filing of a new statement.

The Corps immediately began work on a new environmental impact statement and on 8 November 1974 the 1,967 page final statement was filed with the President's Council on Environmental Quality. The government and local interests promptly filed a motion with the Federal Court asking for dismissal of the injunction so that construction could recommence. Envrionmental interests continued active opposition, in spite of the fact Congress had significantly altered the project to provide fish and wildlife mitigation – conservation measures. The Water Resources Development Act of March 1974 had modified the plan to include acquisition by fee or easements of up to 70,000 acres of land (which represents a large majority of remaining woodlands) for fish and wildlife management, recreation, and environmental purposes. A hearing on the motion for removal of the injunction was held in Federal Court on 17-20 November 1975. On 22 March 1976, the Court ruled the environmental impact statement was adequate and the injunction would be dissolved clearing the way for further work on the project.

During 1972, the 622 man engineering crew placed revetment at several locations. Bank protection was placed on about 7 miles of river bank at a cost of approximately 5.6 million. At the end of the fiscal year, the Memphis District had in place 1,658,155 linear feet of effective revetment. Other channel work brought the total dike construction to 486,950 linear feet. At the end of fiscal 1972, 1.086 miles of levee, out of a total 1,175.5 miles authorized, were completed to grade and section. These levees received a severe test in 1973, the worst flooding in more than a decade.

The Memphis Engineer District had not experienced a major flood since 1961. Nevertheless, in the last week of February 1973, the Memphis Engineer District, along with other districts in the Lower Mississippi Valley Division, participated in a mock flood fight operation. This hypothetical flood was prompted by heavy rains over the drainage basin and higher than average river stages during December, 1972. Mean river stage at St. Louis, Missouri, was five feet above normal. At Cairo, Illinois, the mean stage was higher than those that preceded the great floods of 1927 and 1937. Mean stages at Vicksburg and New Orleans were the highest recorded since 1919.[96]

On March 17, 1973, the United States Weather Bureau predicted a major rise in the Mississippi River during the next week and predicted a stage of 40.4 feet for Memphis – 6.4 feet above flood stage. On the same day, Colonel John V. Parish, District Engineer, announced the establishment of an emergency flood operations center that would remain open 24-hours a day. Phase I of a two-phase emergency flood fight was initiated by the

District Engineer under Public Law 99. Under Phase I conditions, the District office began a program of review and surveillance, beginning levee patrols and checking other flood control structures. Phase II, if implemented, would consist of the actual flood fighting stage when key men are dispatched to selected areas to take command of all flood related situations.[97]

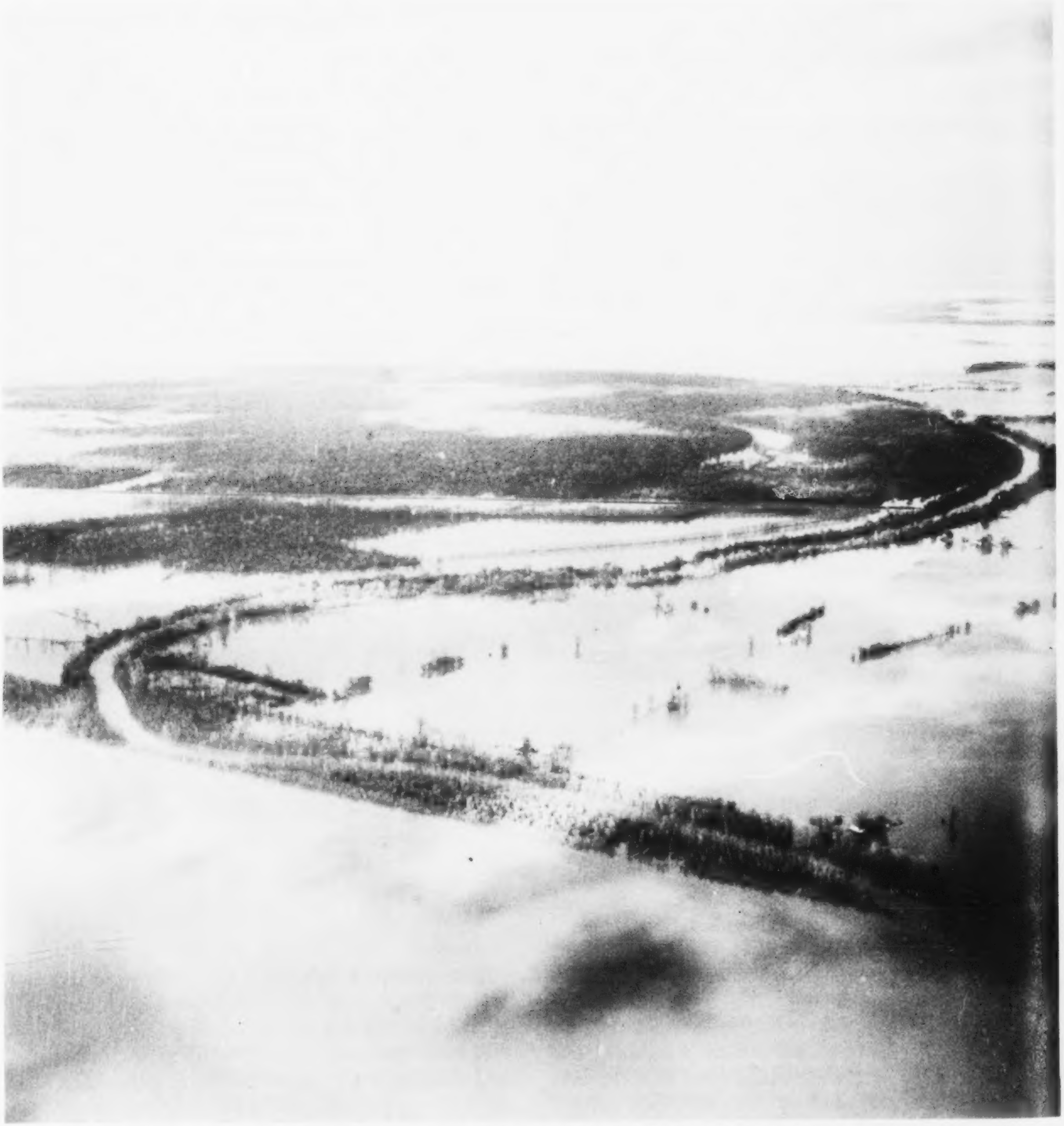
By March 19, the West Memphis Evening Times reported that curious people were going down to the river front to watch the "heavily churning" water rush by, and that the water was already up to the edge of the bank at the south end of Eighth Street.[98] At Kaskaskia Island, north of Cairo, the Corps of Engineers was assembling an evacuation force preparing to remove the island's 300 residents, and at Cairo there was already talk of flooding the Birds Point-New Madrid Floodway.[99] In Missouri, the highway between Dutchtown and Blomeyer was not yet closed, though covered with six to eight inches of water, and there was some flooding in residential areas of the bottom lands of Cairo.[100]

The first operation of the emergency was to order the closing of flood gates at Cairo, Illinois; Hickman, Kentucky and Caruthersville, Missouri. The action was initiated because the Mississippi had already reached the flood stage at these locations. Cairo, Illinois was a critical area for the District, because what happened there would determine whether or not the Birds Point-New Madrid Floodway would be placed in operation. Cairo is located on a point at the confluence of the Mississippi and Ohio Rivers, and stages recorded on the Cairo gage reflect the condition of both the Ohio and Mississippi Rivers.

The Birds Point-New Madrid Floodway was designed to be placed in operation when a stage of 58 feet was recorded at Cairo and a stage of 60 feet had been forecast. On March 23, 1973, the stage at Cairo was 54.3 and the predicted crest stage was continually being increased. Colonel John V. Parish, District Engineer, ordered the upper fuse plug section of the levee be raised to an elevation equivalent to 60 feet on the Cairo gage. The emergency operation was prompted by a review of the 1937 flood. In 1937, river crests had risen one and one-half feet per day or three feet in a two day period. Though a stage of 60 feet was not predicted, additional rains could push the river over the 58 foot stage and prematurely place the floodway in operation.

Phase II emergency operations were ordered for the area and contracts were awarded for raising the levee approximately two feet. Several bulldozers and other heavy equipment were assembled. Portable lights would be necessary for the operation because it was planned to work around the clock until the work was completed. An intensive search had to be made for these light sets because the District had no such equipment. Portable lights were made available to the District by the U. S. Air Force Base at Blytheville, Arkansas, and the Navy installation at Millington, Tennessee.

Operations began on the afternoon of March 23rd. The emergency work involved moving approximately 35,000 cubic yards of dirt from the land side of the levee and piling and shaping it on top of the levee. Operation of the heavy equipment was made extremely difficult by continued rains and high winds. When the bulldozers pushed the dirt to the



The 1973 Flood created a vast inland sea, as is obvious in this aerial view of the Mississippi River at the mouth of the Obion, near Dyersburg, Tennessee.

top of the levee, they were only a few feet from the water, which had now risen to within 15 inches from the top of the levee. In 36 hours, contractors and District personnel completed raising the 11 miles of levee about two feet, and the operation prevented major flooding in the 130,000 acre floodway. If it had been necessary to place the floodway in operation, damages inside the floodway would have amounted to $31,285,000.[101]

By March 22, the high water had floated a dry-docked P.T. boat which had been stored on Mud Island by its owner, James M. (Boats) Newberry.[102] On March 23, Colonel Parish ordered Phase II Mobilization for the Birds Point-New Madrid Floodway, while announcing that flood storage along the Ohio River above Cairo had reached maximum capacity, thus any waters at that point would have to come down the Mississippi.[103]

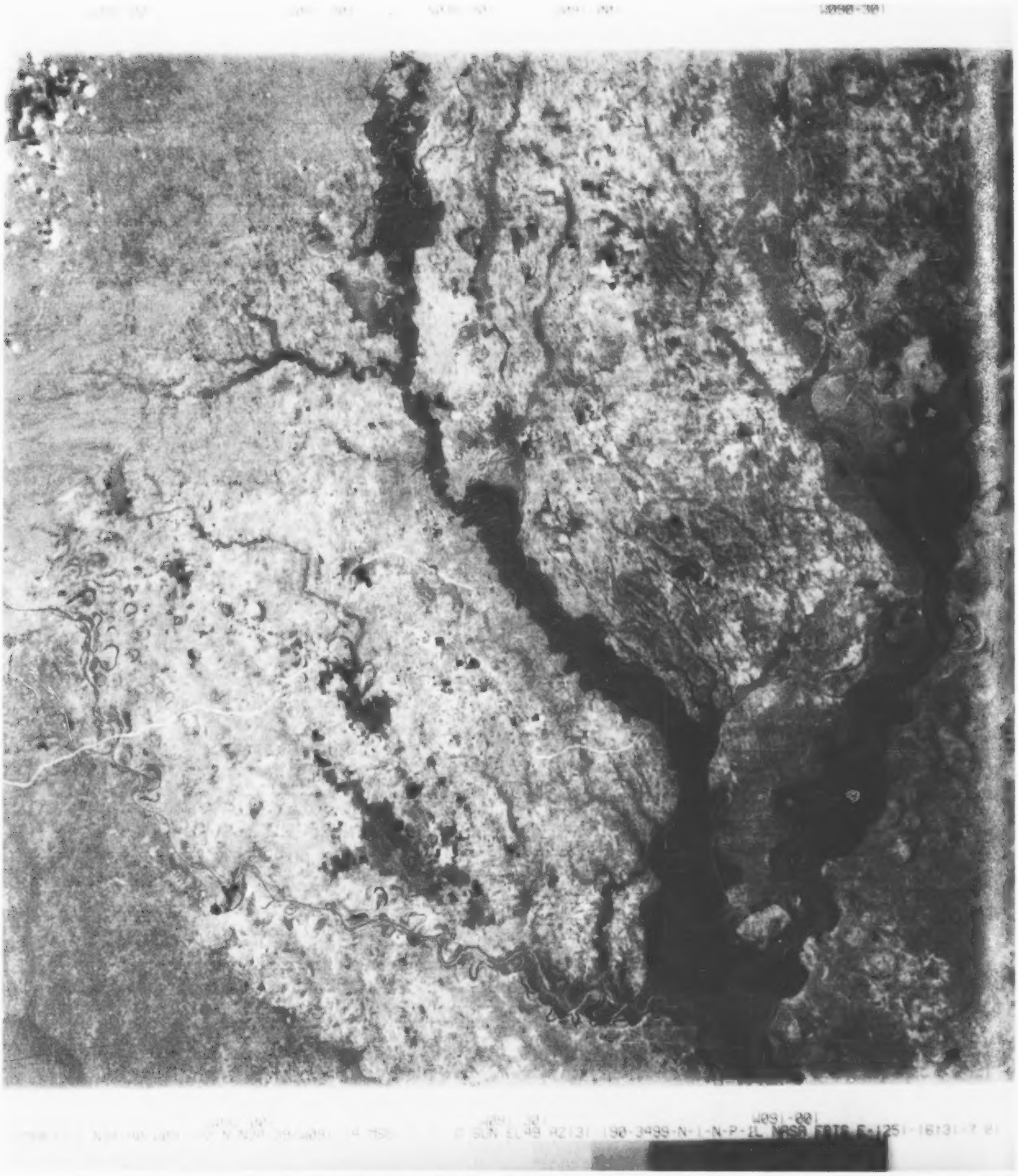
On March 24, the first levee break occurred. It was a private levee near the mouth of the Obion, and resulted in the flooding of about 1,000 acres of pasture land,[104] but it seemed to be the harbinger of greater disasters. Within the next few days approximately 250 families were forced from their homes in the Memphis District and the water had inundated about one-half million acres. Volunteers were pressed into the flood fight in West Tennessee. Phase II operations were declared for Lake County where seepage and slides were a potential threat to the levee. The problem came from caving along a levee road running parallel to the main levee and on the inland side along the toe of the levee. Had the road continued to cave, it would have taken the levee with it. A group of 40 inmates from Fort Pillow State Prison offered their services to help Lake County road crews to repair the threat to the main line levee.

In northwest Tennessee, the Obion River began to flow backward because of backwater from the Mississippi River. The community of Chic, Tennessee, in Dyer County was covered by water.

About 20 houses were flooded and all 75 residents evacuated. In part, this flooding was the result of a crevasse in a private levee. The main levee in this area was about three miles back from the river, and local interests had constructed a "little levee" to protect the area between the main levee and the river. The Memphis Engineer District had assisted local interests in placing 20,000 sand bags to protect the smaller levee but high winds, reaching 45 miles per hour, forced water over the levee and washed out several gaps. When water poured over the levee, it covered about 3,000 acres of sparsely populated farmland.[105]

The Memphis Engineer District ordered Phase I activities be initiated at Memphis, Tennessee on April 3rd. Phase I was the result of minor flooding along the Loosahatchie and Wolf Rivers and Nonconnah Creek. Several sand boils and seepage developed along the levee that protected the dock and repair shops of Memphis Engineer District. In addition, the Memphis Public Works Department had to construct a wall of sandbags at John B. Edgar Point to prevent the Mississippi River from encroaching onto Riverside Drive. The same situation occurred at Hollywood Street cause by the Mississippi River backing up Wolf River.

Individual tragedies abounded, as hundreds of thousands of dollars in farm machinery and even late model cars were trapped in the rising waters. From the air it was easy to see that the owners had driven the vehicles or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Satellite view of a large part of the Memphis District. Taken from a height of 517 miles, and put through several color washes to bring out specific details, the picture shows the Mississippi River at the right, from Memphis to the Mouth of the Arkansas River. At center is the White River Valley, with its various tributaries. The Arkansas River enters the picture at left-center of the picture, at about Little Rock. The fleecy spots at the upper left are clouds.

A tow making its way upriver at Memphis. The PT boat perched on Mud Island was a landmark for many years, floating from one position to another in flood times. After the 1973 Flood the owner decided to relocate the boat to a place where it would be better appreciated.

machinery to the highest ground, but it was seldom high enough. Livestock and wildlife could be seen on isolated knolls or levee sections, or even trying to climb on top of structures or machinery. It was reported that the water was so high that a large boat could be taken from Helena, Arkansas, to Memphis without ever entering the main navigation channel, as there was deep water in all the old bends and chutes, and across many of the points.[106] Chickasaw Bluff No. 2 was caving heavily, carrying with it 80 foot trees and even picnic tables, and an illegal dump near Osceola was losing its treasures to the raging river.

The first of two major crests reached Memphis on April 5th with a stage of 40.4 feet, 6.4 feet above flood stage. A slow fall of the river began and the Memphis Engineer District began to breathe a little easier. The District considered itself lucky because most of the flood water had come from the Upper Mississippi while the Ohio River had continued flowing at about an average rate. During the early part of this flooding, the District had been in an unique position. The Mississippi River was out of its banks both above and below the District.

On April 19th and 20th, torrential rains over the Memphis District halted the decline of the river and a slow rise of the river resumed. Heavy rains caused flash floods in several areas of Southeast Missouri, Eastern Arkansas and West Tennessee. The Memphis Engineer district estimated that the flash floods caused additional damage amounting to approximately $4 million dollars. As of April 23rd, the Memphis Engineer District had initiated Phase I operations in the areas of the Lower White River, the St. Francis River and Memphis. Phase II activities were confined to the Cairo area and Reelfoot-Obion area. At this point, approximately 300 Engineer personnel were involved in the flood fight.[107]

Additional problems were created by the heavy rains of April 19th and 20th. The runoff had no place to go because high water against flood control structures prevented it from entering the river. Requests for pumps came in from all parts of the District. Approximately 60 percent of New Madrid, Missouri, was flooded from interior drainage. During the height of the flood, the District loaned or used 29 pumps. These pumps were an innovation in flood fighting for the Memphis District. In every sense, the pumps were portable. They were so constructed as to be powered by any available farm tractor. The pumps were placed where needed and tractors brought to the area. Farmers eagerly donated or rented the use of their tractors.

The St. Francis Floodway, near Truman, Arkansas, during the Flood of 1973.

The St. Francis River in flood. View northeast from Marianna, Arkansas. Flood of 1973.

The Memphis Engineer District received its second break during the rise in the river that culminated in a crest stage of 40.5 feet on May 24th. Most of the water came from the Ohio River, while the Upper Mississippi was slowly declining. Had both rivers been in flood, the stages on the Lower Mississippi might have surpassed the record stages of 1927 and 1937. The stage of 40.5 feet surpassed by tenths the 1950 stage at Memphis -- the third highest stage ever recorded at Memphis.

One of the most intensive emergency operations occurred during the second flood crest that visited Memphis Engineer District. Just below Commerce, Missouri, the Mississippi River flows east of a land mass known as Powers Island. The main line levee had been constructed west of the island, but a private levee had been built to protect the island. Heavy pressure by the river crevasssed the private levee and the current was thrown directly into the main line levee. Winds up to 45 miles per hour pounded six-foot waves against the levee and the attack began to erode large sections into the river. Polyethylene sheeting was placed on a section of the levee approximately 1,500 feet long, but high winds and strong currents quickly destroyed most of this wave wash protection. The current cut the face of the levee until the caving had reached the crown of the levee. The levee had to be saved because a crevasse at this point would probably flood the entire St. Francis Basin. It was decided to place rip-rap stone on the caving section, but no road led to the area. That problem was solved by the construction of a gravel road on the crown of the levee. However, the area commander decided that such a road, on top of a waterlogged levee, could not withstand the pounding of trucks loaded with tons of riprap. To meet the critical need for riprap, the commander requested the riprap be brought to the area by barge. Several barges loaded with thousands of tons of riprap were pushed to the area by towboats. Towboat pilots feared that they could not make it across flooded Powers Island to the critical area, but the engineers employed a sounding device to plot a zig zag channel, and the towboats had no further difficulty in navigating across Powers Island. Riprap was placed directly from the barges. By light truck and barge, 18,114 tons of riprap was placed on the wave wash areas. The wash protection dramatically halted the caving and saved a large area from inundation.

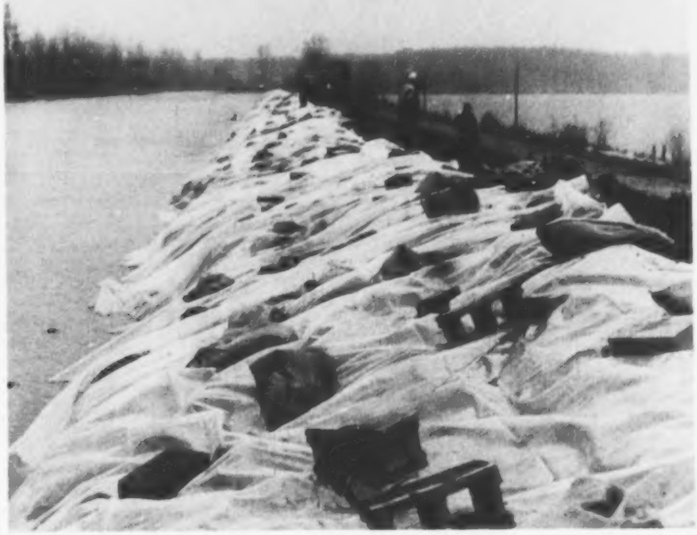
Without the help of the public, the Memphis Engineer District would have had a more difficult job of containing the flood. Students from East Prairie, Missouri and Southern Illinois University assisted the Corps of Engineers in the upper reaches of the Memphis District.[108]

In the lower part of the Birds Point-New Madrid Floodway, water backed through a gap in the levee forcing several families from their homes. With water on both sides, the levee was the only dry area. Several dogs had made their way there as the water converged. Because of hunger, the dogs were becoming dangerous to Corps personnel patrolling the levee, but the engineers dipped into their own pockets to feed the dogs. News of the dogs' condition finally reached the Memphis Humane Society and the Ralston-Purina Company was contacted. Ralston Purina donated about 200 pounds of dog and cat food which was then carried to New Madrid by both the Engineers and Human Society members.

The District Engineer, Colonel John V. Parish was due to be rotated out but stayed on through the emergency making almost daily inspection flights over the entire District. Flood protection projects held damages to a minimum. No main line levee or flood control structure was breached by river stages that set a record for sustained flooding at Memphis. The Mississippi River went out of its banks on March 22nd and did not return until May 24th. For 63 days the river was out of its banks and it eclipsed the 61 consecutive days of flooding in 1927, the 50 days in 1950 and 40 days in 1937. The Memphis Engineer District expended approximately $1,850,000 on the flood fight. During the emergency period, 242,900 sandbags were issued; 144,600 square feet of polyethylene was used for wave wash protection; 29 pumps were loaned or used by the District; and 23,114 tons of riprap was used to hold down the wash protection.[109] The River had tested the works of the engineers, and those works had stood the test with honor.

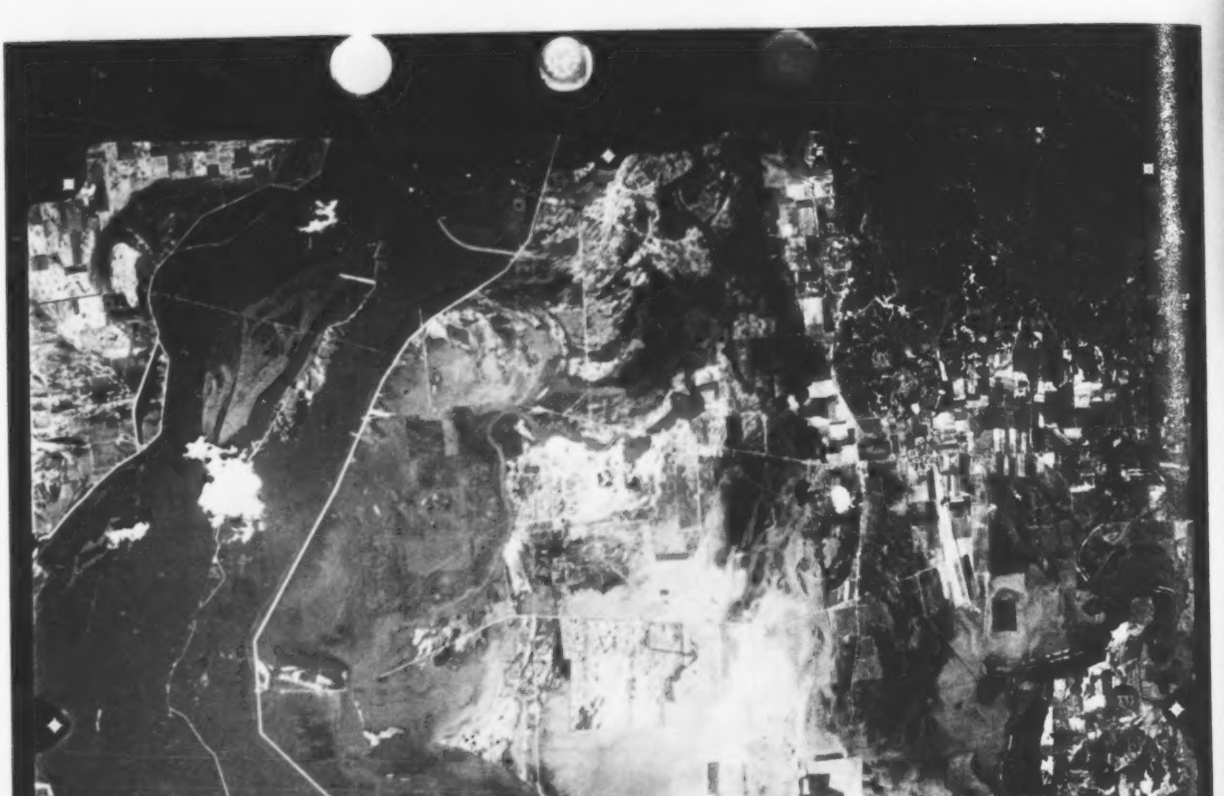
The flood of 1973 caused damages estimated $183,756,000 which is a staggering amount until compared to the damages that would have occurred had not man spent many years in preparation for such a flood. The damage estimate, including agricultural losses (crops, livestock, machinery, buildings), and urban (residential, public, commercial, utilities), as well as traffic disruption, evacuation, bridges, etc., of nearly $184 million compared to estimated damage without Mississippi River and Tributaries projects (within the Memphis District) is $865,719,600 less than would have occurred without the projects, or to put it another way, for each million in damage actually suffered there would have been almost $6 million in additional damage without the Corps projects.[110] The flood control structures had saved over 7,574,680 acres (agricultural, wooded and urban) from inundation within the Memphis District alone, and enabled some 6,000 persons to remain in their homes despite the height of the river. Throughout the Lower Mississippi Valley the statistics were proportionately impressive. It was estimated that the Mississippi River and Tributaries Project had prevented damages of $7,225,400,000, and a lot of human suffering for which no value could be established. Even with the projects in place, the Great Flood of 1973 had unindated 12,623,000 acres of land and forced the evacuation of 50,225 people.[111]

In 1974, there was an occurrence which in a way seemed to bring a tragic end to a romantic era. The powerful, historic, and majestic Sprague suffered a disastrous fire

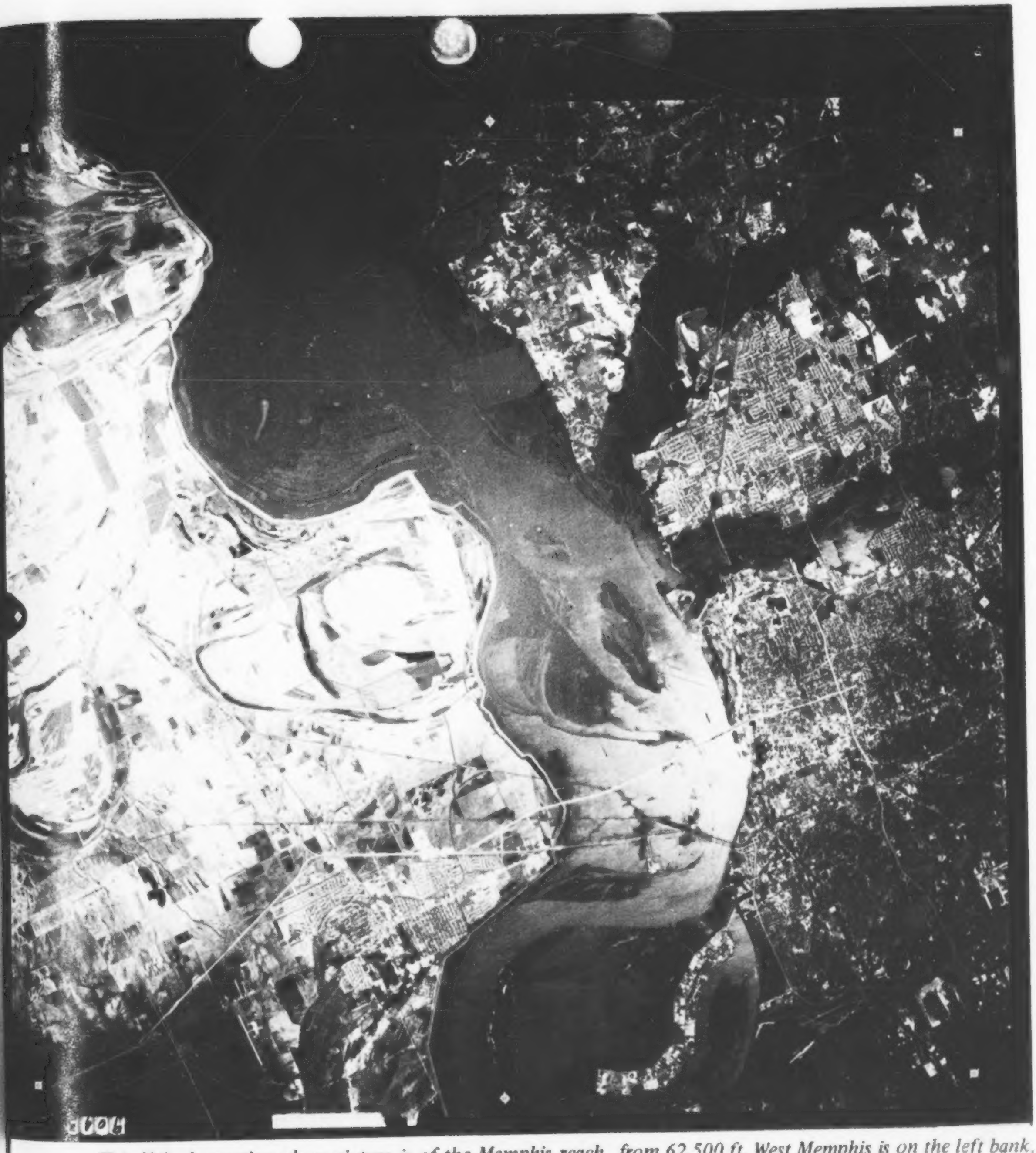


A recent development in emergency bank protection, polyethelene laid and weighted down on levee slope to minimize damage from wavewash and current erosion. Birds Point - New Madrid levee, near Dorena, Missouri, during Great Flood of 1973.

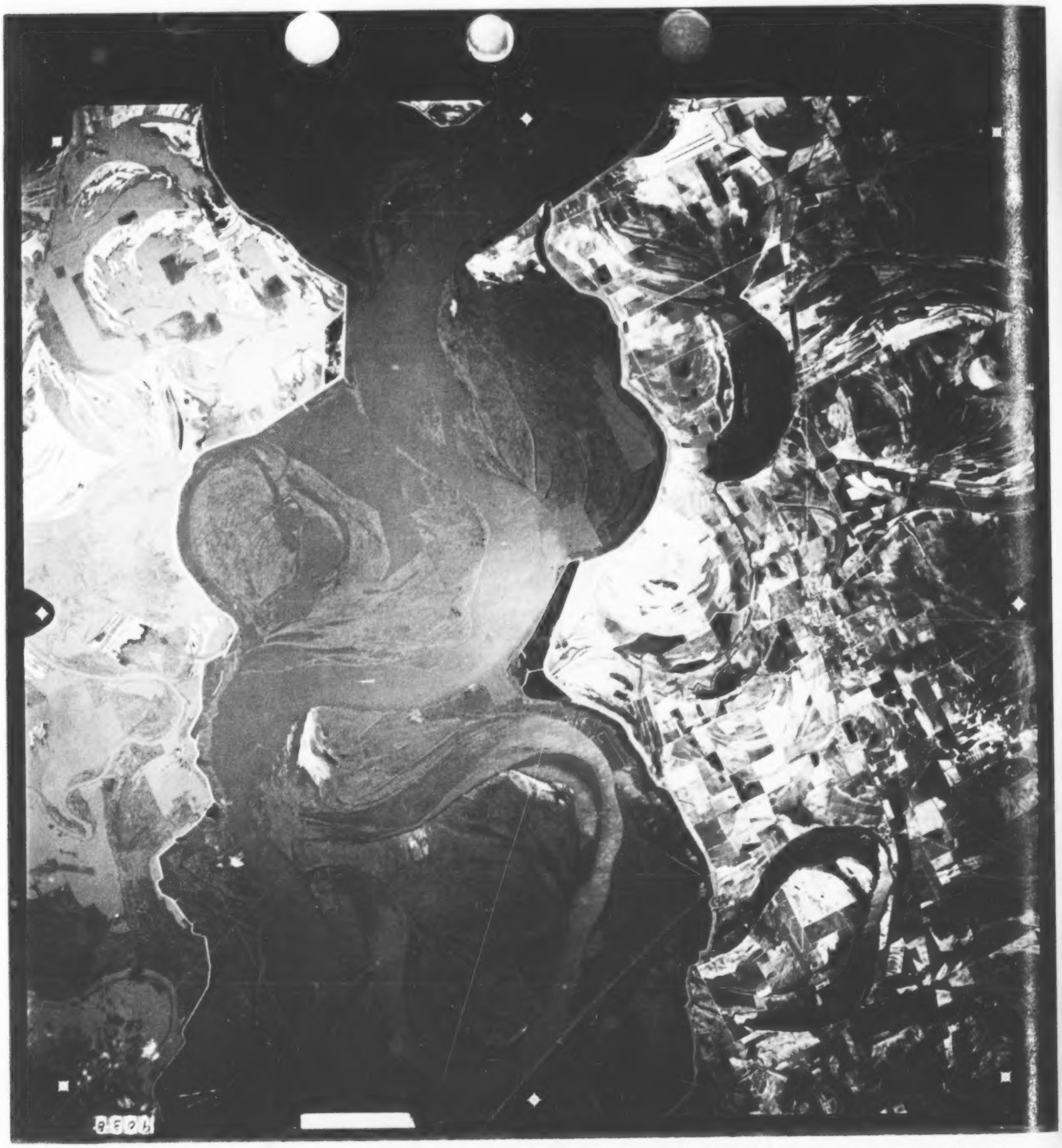
which, at least of this date, has ended a long and lustrous river career. The Sprague had been the best known of the working sternwheelers to ply the Mississippi. Constructed by the Dubuque (Iowa) Boat and Boiler Company, it was launched in late 1901 and commissioned in 1902. The hull was 276 feet by 61 feet by 7.4 feet, and after the superstructure was added its overall dimensions were even more impressive at 318 feet by 65 feet standing 51 feet above the waterline. The Sprague, named after the construction superintendent, Peter Sprague, had been constructed for the Monongahela River Consolidated Coal and Coke Company, and from the date of its first tow it captured the imagination of all who witnessed it. Its "wood-pile," the paddle wheel, was a great forty-foot paddle wheel that gave the Sprague mastery over any conceivable tow, and caused a nine foot wake that often swamped unsuspecting smaller craft, houseboats and even people who were caught at shoreline. The original design specifications had indicated that the paddlewheel could be driven to 16RPM, but according to a Sprague hobbiest and historian, such was not to be. Jack Custer, of Nashville, has compiled a great registry of facts and pictures of the Sprague, and has found that the maximum revolutions of the paddlewheel was but 9RPM, with the engines producing an estimated 1,000-2,000 HP. Considering the destructive wake caused by the Sprague when the wheel was turning little more than half of its estimated potential, it is fortunate that the original design specifications could never be achieved. In 1907, the Sprague made what is still the record tow on the Mississippi, it commanded a tow of 61 coal boats and barges, carrying 67,307 tons of coal, from Cairo to New Orleans. To transport the equivalent load by rail would have required fifteen trains of 100 cars each, or 1,500 railroad cars. In 1925, the Sprague was sold to Standard Oil of New Jersey, Louisiana Division, and it became the workhorse of their fleet until its retirement in 1948. A nostalgic article written upon the occasion of its last visit to Memphis noted that the Sprague was an indelible part of the River history, and that the "Big Mama" would never be forgotten. Fortunately, Standard Oil also recognized the historic significance of the Sprague, and agreed to deed it over to the city of Vicksburg for the sum of $1, on condition that it be made into a river museum. Until the disaster of 1974, the old Sprague did more than its share in preserving river lore, serving not only as a museum but as a theater for the production of old Gay Nineties melodrama productions. In 1950 MGS studios featured the Sprague in the starring role of its movie, "Showboat." The fire which engulfed the Sprague during the night of April 15, 1974, also gutted hearts of many a romanticist. The Vicksburg Fire Department responded immediately, but was frustrated by the fact that there was only one fire plug in the vicinity. Had not the U. S. Engineers sent the towboat Fife with a fire fighting barge, and the Coast Guard also responded with the fireboat Dogwood, nothing would have been saved. As



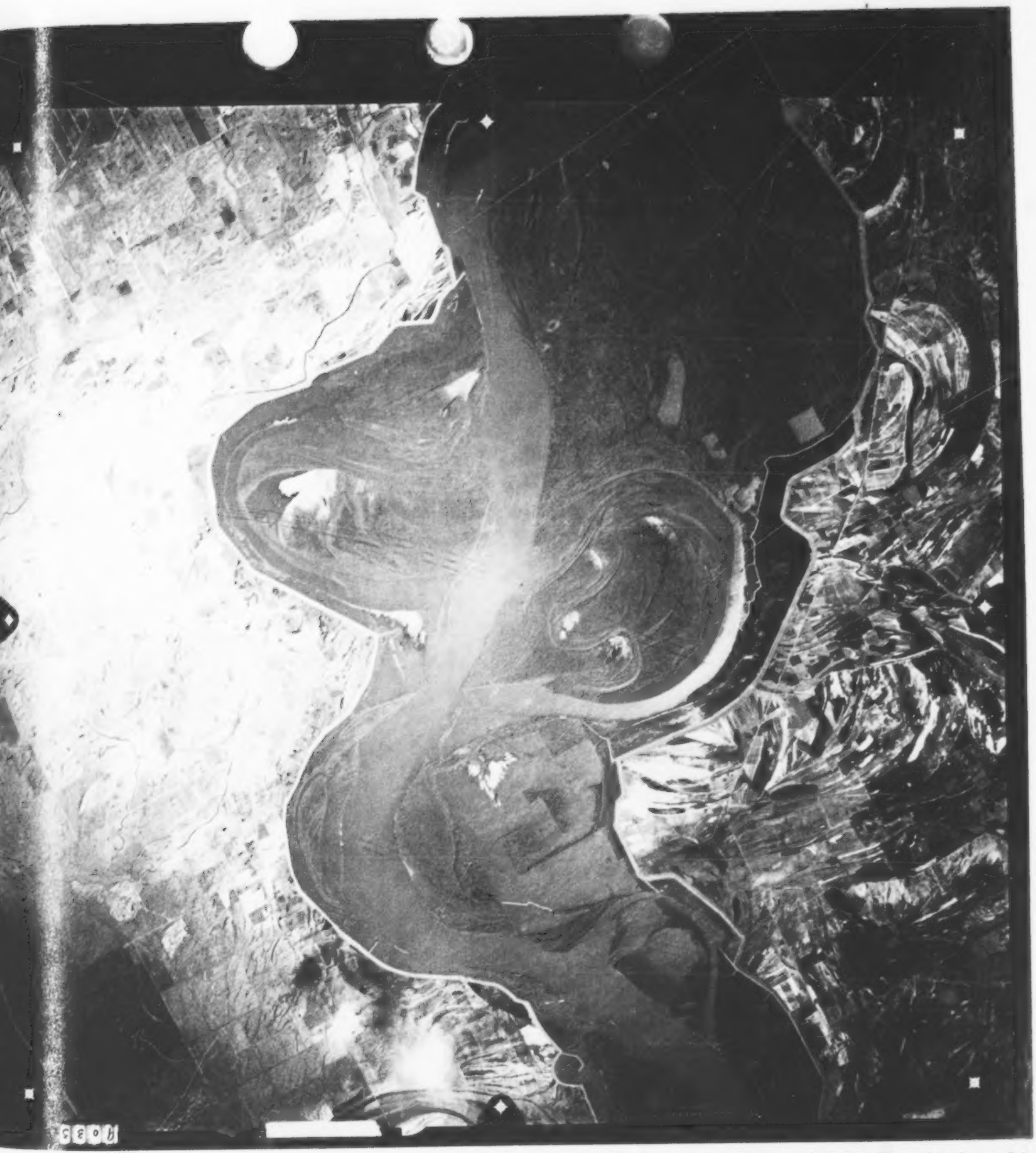
U-2 photo of the Mississippi in the Flood of 1973. At the bottom end of the mainline levee is the gap where the Obion empties into the Mississippi. Unable to flow into the flooded Mississippi, the Obion has backed up to flood the areas behind the Mississippi Levee system. About 85 miles above Memphis.



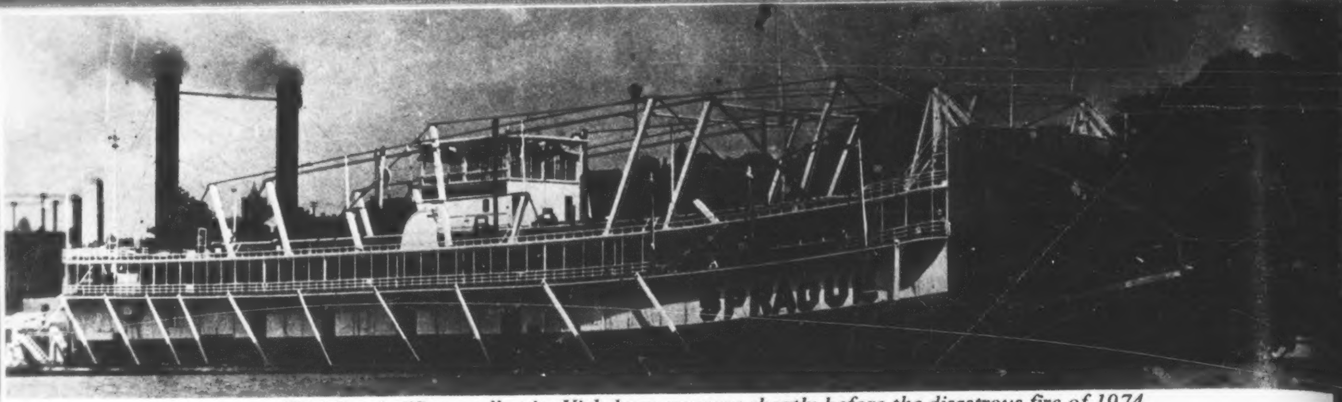
This U-2 observation plane picture is of the Memphis reach, from 62,500 ft. West Memphis is on the left bank, and the Loosahatchie and Wolf River flood valleys are evident above Memphis. The River is approximately five times its normal width at Memphis. In the lower right-center of the picture is old Memphis headquarters, protected by its levee system. Just below the old headquarters, on the south bank of the channel, is President's Isle and the new Memphis Harbor. April 11, 1973.



This picture, from an altitude of 62,500 ft., encompasses an area about 18 miles wide. It can be seen that in past times the Mississippi River bed has changed its course hundreds and even thousands of times within a meander belt that is up to fifty miles wide. To the left of the picture the light-blue flood waters are in stark contrast to the dark blue flood waters of the Mississippi River. It is the St. Francis River that has flooded the area behind the levee, a condition that will be mitigated when the Huxtable pumping plant is completed and in operation. The St. Francis River can be seen as a small out-lined ribbon within the flooded area.



High altitude picture of the Jackson Point-Sunflower cut-off, during the Flood of 1973. The old channel is clearly visible, along with unmistakeable evidence of earlier channel meanderings. At the bottom center of the picture the historic Knowlton levee break is seen as a bite out of the left bank. The flood plain, large as it is, would be much larger if the main line levee system was not doing its job. April 11, 1973.



The historic "Sprague" at its Vicksburg moorage shortly before the disastrous fire of 1974.

it was the fire was so intense as to melt the "hog" chains and collapse the superstructure. The hull, which had just been replated, held and thus the Sprague stayed afloat. Also, the great paddlewheel at the rear of the boat was kept isolated by a wall of water, so there is still a possibility of restoration. The State of Mississippi, wonderfully steeped in appreciation of history, has already allotted $1,000,000 toward that restoration, and the Louisiana Legislature has also allotted a sizeable sum to that end. Several historical organizations have promised to initiate a campaign which will raise the additional monies needed, so the Sprague may yet be reborn.[112] Like the work of the U. S. Engineers, the Sprague is too much intertwined with the history of the River to be lost or forgotten.

The Memphis District is presently under the direction of Colonel Albert C. Lehman, of Pomona, California. His appointment came just as the Great Flood of 1973 had passed its crisis. Colonel John V. Parish, Jr., was proud to turn over to Colonel Lehman an organization that had so effectively confirmed its worth.

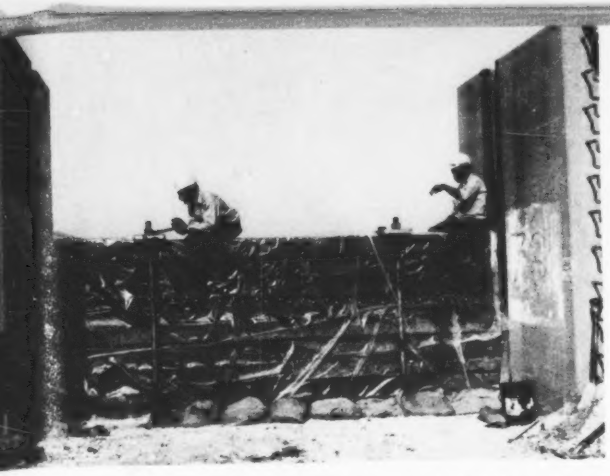
Highwater again in 1975 drove the Mississippi River to a crest stage at Cairo, Illinois, of 56.5 feet, the second highest stage ever recorded there and exceeded only by the great flood of 1937. Downriver, the stage readings at other gages were high, but not of such a record making level. For example, the stages at both Memphis (40.3 feet) and Helena (47.9 feet), were significantly lower than 1937 (Memphis 48.7, Helena, 60.2).

This flood also differed in sharp contrast to the floods of 1973-4, which were both preceded by above normal rainfall and correspondingly high stages, in that only normal rainfall amounts had occurred and there were relatively low river stages – a combination which gave the district no indication of a probable flood threat. The experience of 1973-74 had been a good teacher, however, and Colonel A. C. Lehman, wisely took the necessary steps to fight a flood in 1975 should conditions suddenly worsen. Accordingly, the Memphis District began an inventory of the stock of sandbags, riprap stone, polyethylene, pumps, and various other flood fighting materials while simultaneously reviewing the flood fight plan.

The year had an upward series of crests at Cairo that could have easily led into one of the great floods of all time:

41.4 feet on 16 January 1975
42.4 feet on 9 February 1975
45.8 feet on 28 February 1975
52.3 feet on 24 March 1975
56.5 feet on 3 April 1975

By the 26th of February, the Mississippi at Cairo had crept up above the 44.0 foot bankfull stage only to crest out at 45.8 feet two days later. After a short fall, a new and rapid rise began and bankfull was again exceeded on March 14th with no crest in sight. On March 20th, with a stage of 51.2 feet on the Cairo gage, Colonel Lehman ordered a Phase I Mobilization for the Cairo Area. This area includes the small portion of Illinois located in the immediate vicinity of Cairo and larger sections of Missouri, Kentucky, and Tennessee. An Emergency Operations Center was established at the Memphis District Headquarters in the Clifford Davis Federal Building to monitor the developing flood and provide flood information to the public.



Highwater 1975 - Fourth Street Gate Closure, Cairo, Illinois.

To protect themselves against the rising river, local flood control officials at Cairo, Hickman, Ky., and Caruthersville, Mo., began closing floodgates and making other emergency preparations. Preliminary planning toward the possible use of the Birds Point-New Madrid Floodway was begun at the Memphis District Headquarters, even though the crest stages were well below the 60 foot crest stage at which the floodway would be placed into operation.

Following a heavy rainfall, and with a stage at Cairo of 55.2 feet, on March 31st the District moved into a Phase II mobilization in the Cairo Area and also in the Missouri and Reelfoot-Obion Areas. The remaining areas of the Memphis District lying along the Mississippi River were placed in a Phase I status.

This same rainfall led to the failure of two private levees which were protecting over 14,500 acres of land outside the mainline levee system. The Dyer County (Tennessee) Little Levee below Booths Point, protecting some 13,000 acres, was overtopped on March 30th in spite of intensive efforts by the local people to save it and, the next day, the Tennemo Levee above Booths Point breached

Private Levee Break, Dyer County, Tenn., April 1975.

Highwater 1975 - Flooded home (owner Jim Perry), Tennemo Road, Dyer County, West Tennessee.

and flooded a 1,563 acre area.

Although the District's hired labor forces were never committed to a major flood fight effort, there was still full involvement in performing surveillance activities, furnishing advice to local interest organizations, and supplying the necessary materials for local efforts. During the 1975 flood, a total of 223,871 sandbags, 359 rolls of reinforced polyethylene sheeting, 2,300 tons of riprap stone, and 28 pumps were issued.

Although there were no major problems with the mainline flood protection works, the District had to keep close watch on the customary damages from wavewash, seepage, sandboils, sloughing of slopes on the landside of levees because of heavy seepage, and flooding caused by impounded rain and seep water. At Mounds City, Ill., there was some seepage and in Cairo several major street failures, also from seepage. Cairo also had a minor problem from a leaking flap gate. Hickman, Ky., suffered considerable flooding from impounded rainwater within the city and the same problem caused some flooding in New Madrid, Mo.

At the height of the flood, approximately 500 people had been forced from their homes and floodwater was covering 2,499,000 acres, but this area was located either in the flood plain or in the unprotected lowlands where tributary streams enter the Mississippi through openings in the levee system. A large part of the flooding was in West Tennessee where the Obion and Forked Deer Rivers empty into the Mississippi and in Arkansas near the mouth of the St. Francis and White Rivers.

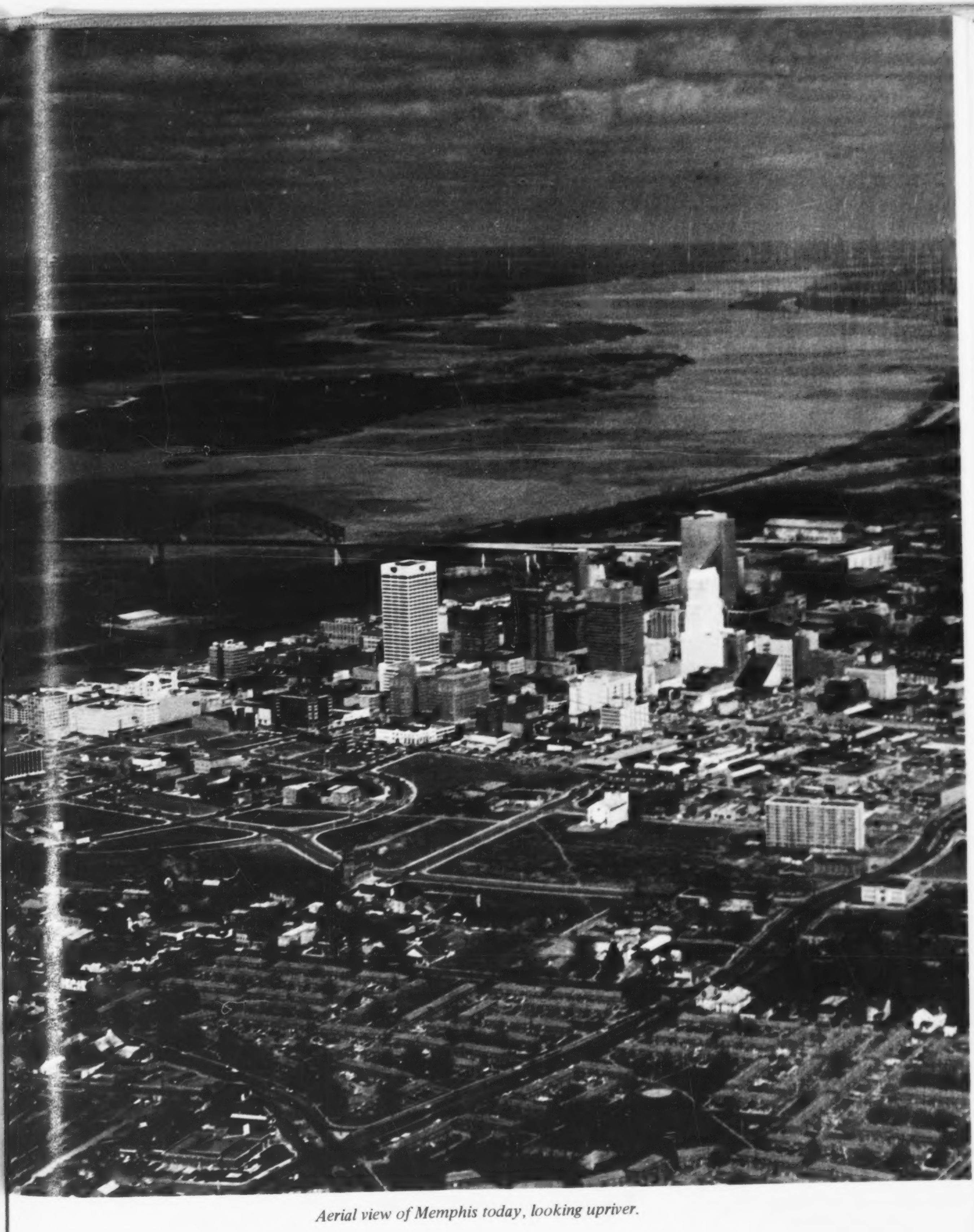
At the peak stage of 56.5 feet at Cairo, the flow in the Mississippi River totaled 1,656,000 cfs with 27 percent coming out of the upper Mississippi River and 73 percent from the Obion River. The longest period when the river was above bankfull stage at Cairo (44.0 feet) was the 32 consecutive days from March 14th to April 15th. At Memphis, the 34.0 foot bankfull stage was exceeded on March 22nd. The river crested there at 40.3 feet on April 7th, and then receded below bankfull on April 16th, a period of 26 consecutive days.

By April 10, 1975, with river stages falling, flood fight efforts by the Memphis District were terminated.

The 1975 flood had caused $6,675,000 in damages within the Memphis District and the expenditure of $400,000 in flood emergency funds. But the effort had paid off. The flood protection works had prevented an estimated $586,433,000 in damages which would have occurred without them.

The Editor of the East Arkansas Record once volunteered a tribute that was modestly but gratefully accepted by the Corps of Engineers: "The Corps of Engineers has proved itself to be a constructive and productive branch of the service. It wins notable victories in peace that are of greater consequence than victories of war."[113]

That is what it is all about.



Aerial view of Memphis today, looking upriver.

Notes

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[45] Memphis *Commercial Appeal*, February 11, 1903.

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[48] Figures interpolated from statistics furnished by rail and barge lines, June 29, 1973.

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[69] *Ibid.*, p. 2081.

[70] Records Division, *File E-1-1*.

[71] *Commercial Appeal*, December 9, 1931.

[72] *Ibid.*, November 5, 1931.

[73] *Annual Report of 1931*, p. 2092.

[74] Elliott, *Improvement of the Lower Mississippi*, p. 200.

[75] Records Division, *File E-1-8*.

[76] *Annual Report of 1931*, p. 2084, 2086.

[77] Elliott, *Improvement of the Lower Mississippi*, p. 278.

[78] *Annual Report of 1931*, p. 1696.

[79] *Commercial Appeal*, October 3, 1931.

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[1] *Ibid.*, May 21, 1932.

[2] *Annual Report of 1932*, p. 1986.

[3] *Commercial Appeal*, April 17, 1931.

[4] Moore, *Improvement*, p. 58.

[5] *Annual Report of 1932*, p. 1972.

[6] Records Division, *File E-1-1.*

[7] *Ibid.*, File E-1-3.

[8] *Ibid.*, File E-1-4.

[9] *Ibid.*

[10] *Commercial Appeal*, March 22, 1933.

[11] *Annual Report of 1933*, p. 1282.

[12] Somervell, *Dredging in the Mississippi*, p. 5.

[13] *Commercial Appeal*, March 13, 1933.

[14] Gladfelter, *55 Years of Dredges and Dredging*, p. 108.

[15] *Commercial Appeal*, April 23, 1933.

[16] *Annual Report of 1933*, p. 1296.

[17] Elliott, *Improvement of the Lower Mississippi*, p. 7.

[18] *Memphis Sunday Appeal*, Dec. 22, 1872; Memphis *Public Ledger*, Dec. 27, 1872.

[19] Vogel, *Vogel On Cut-offs*, p. 19.

[20] Brown, *Brown on Cut-offs*, p. 22.

[21] *Annual Report of 1936*, p. 1694.

[22] *Ibid.*, p. 1695.

[23] *Ibid.*, p. 1694.

[24] *Ibid.*, p. 1691

[25] *Ibid.*, p. 1692.

[26] Matthes, *Cut-offs*, p. 13.

[27] Story related by "Dutch" Haas, Interview, July 18, 1972.

[28] Memphis Engineer District, *Report on Bessie Cut-off*, p. 33.

[29] *Commercial Appeal*, March 22, 1934.

[30] *Ibid.*, March 27, 1934.

[31] *Ibid.*, June 24, 1934.

[32] Mississippi River Commission, *River Stages of 1934*, p. 24.

[33] *Annual Report of 1934*, p. 1483.

[34] *Annual Report of 1936*, p. 1692.

[35] *Annual Report of 1934*, p. 1483.

[36] *Ibid.*, p. 1487.

[37] *Ibid.*, p. 1490.

[38] *Ibid.*, p. 1498.

[39] *Commercial Appeal*, February 8, 1935.

[40] *Ibid.*, August 23, 1935.

[41] *House Document No. 1* (1935), pp. 8-9.

[42] *Commercial Appeal*, January 22, 1935.

[43] *Ibid.*, January 26, 1935; January 30, 1935.

[44] *Ibid.*, March 18, 1935.

[45] *Annual Report of 1935*, p. 1715.

[46] *Annual Report of 1936*, p. 1691.

[47] Memphis Engineer District, *Document Pertaining to Flood Control*, Vol. 1.

[48] *Commercial Appeal*, September 8, 1935.

[49] *Ibid.*, March 28, 1935.

[50] *Ibid.*, June 4, 1936.

[51] Select Committee on National Water Resources, *Water Resources Activities in the United States: Floods and Flood Control*, p. 12.

[52] *Ibid.*

[53] *Commercial Appeal*, July 25, 1936.

[54] *Annual Report of 1936*, p. 1716.

[55] *Ibid.*, p. 1706.

[56] *Ibid.*, p. 1694.

[57] Record Division, *File E-1-2.*

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[1] Chicago *Herald Examiner*, January 26, 1937. Statement by Damon Runyon.

[2] American Red Cross, *Ohio-Mississippi Valley Flood Disaster of 1937*, p. 11.

[3] Memphis Engineer District, *Flood Reports of 1937.*

[4] Memphis *Press-Scimitar*, January 20, 1937.

[5] Records Division, *File E-1-2.*

[6] Memphis Engineer District, *Flood Reports of 1937.*

[7] *Ibid.*

[8] *Ibid.*

[9] Memphis Engineer District, *Flood Reports of 1937.*

[10] *Ibid.*

[11] B. A. Botkin, ed., *A Treasury of Mississippi River Foklore*, p. 290.

[12] Memphis Engineer District, *Flood Reports of 1937.*

[13] St. Louis *Globe-Democrat*, January 27, 1937.

[14] Memphis Engineer District, *Flood Reports of 1937.*

[15] Records Division, *File E-1-2.*

[16] Memphis Engineer District, *Flood Reports of 1937.*

[17] Records Division, *File E-1-2.*

[18] *Ibid.*

[19] *Ibid.*

[20] American Red Cross, *Ohio-Mississippi Valley Flood Disaster of 1937*, p. 38.

[21] Memphis *Press-Scimitar*, January 29, 1937.

[22] B. A. Botkin, ed., *A Treasury of Mississippi River Folklore*, p. 557.

[23] *Ibid.*, p. 546.

[24] St. Louis *Post-Dispatch*, January 27, 1937.

[25] *Ibid.*

[26] Chicago *Daily Times,* January 27, 1937.

[27] Chicago *Daily Tribune,* January 27, 1937.

[28] American Red Cross, *Ohio-Mississippi Valley Flood Disaster of 1937,* p. 74.

[29] Interview with Alfred C. Anderson, January 26, 1937.

[30] Memphis *Commercial Appeal,* February 21, 1937.

[31] Charleston, Missouri, *The Enterprise-Courier,* March 17, 1938.

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[1] Clay, *History of the Little Rock District,* pp. 26-28; Parkin, *Memphis District History,* p. 2.

[2] Memphis *Press-Scimitar,* April 12, 1973.

[3] Memphis Engineer District, *Memphis Flood Control Project,* p. 2.

[4] *Annual Report of 1944,* p. 740.

[5] *Annual Report of 1937,* p. 1715.

[6] *Ibid.,* p. 1734.

[7] *Ibid.,* p. 1703.

[8] *Ibid.,* p. 1705.

[9] *Annual Report of 1938,* p. 2011.

[10] *Commercial Appeal,* December 10, 1938.

[11] *Ibid.,* August 15, 1938.

[12] Memphis Engineer District, *Operation and Maintenance of Wappapello Reservoir,* p. 3.

[13] Mississippi River Commission, *Mississippi River and Tributaries Project,* Vol. 3, p. 11.

[14] *Ibid.*

[15] *Annual Report of 1938,* p. 2063.

[16] *Ibid.,* p. 2078.

[17] *Ibid.,* p. 2092.

[18] Records Division, *File E-1-18.*

[19] *Annual Report of 1939,* p. 2198.

[20] *Ibid.,* p. 1041.

[21] *Commercial Appeal,* October 1, 1939.

[22] *Ibid.,* March 23, 1939; May 18, 1939.

[23] *Ibid.,* August 30, 1939.

[24] *Ibid.,* October 1, 1939.

[25] *Annual Report of 1939,* p. 2243.

[26] *Commercial Appeal,* October 26, 1939.

[27] *Annual Report of 1940,* p. 2196.

[28] *Ibid.,* p. 2196.

[29] *Ibid.,* p. 2277.

[30] *Commercial Appeal,* September 4, 1940.

[31] *Ibid.,* May 22, 1940.

[32] *Ibid.,* October 10, 1941.

[33] *Annual Report of 1941,* p. 2144.

[34] *Ibid.,* p. 949.

[35] *Ibid.,* p. 945.

[36] *Ibid.,* p. 2237.

[37] *Ibid.,* p. 2200.

[38] *Ibid.,* p. 2147.

[39] *Ibid.,* p. 2189.

[40] *Annual Report of 1942,* p. 6.

[41] *Commercial Appeal,* May 16, 1942.

[42] Records Division, *File E-1-3.*

[43] *Annual Report of 1942,* p. 1944.

[44] *Ibid.,* p. 1929.

[45] Memphis *Commercial Appeal,* Marcy 19, 1942.

[46] *Ibid.,* p. 1919.

[47] Lt. Col. Daniel Noce to Col. Chas. T. Williams, Dec. 10, 1968.

[48] *Commercial Appeal,* January 8, 1943.

[49] *Annual Report of 1943,* p. 1781.

[50] *Commercial Appeal,* April 28, 1971; *Press-Scimitar,* February 12, 1971; Public Affairs Release, January, 1970; Interview, August 19, 1974.

[51] Interview, Joe Overall, October 8, 1974; *Ibid.,* October 15, 1974.

[52] *Ibid.,* p. 1829.

[53] *Ibid.,* p. 1819.

[54] *Commercial Appeal,* May 16, 1943.

[55] *Ibid.,* May 31, 1943.

[56] Records Division, *File E-1-3.*

[57] *Arkansas Gazette,* May 4, 1973.

[58] *Annual Report of 1944,* p. 1788.

[59] *Annual Report of 1945,* p. 6.

[60] *Annual Report of 1944,* p. 1799.

[61] *Annual Report of 1945,* p. 2462.

[62] *Ibid.,* p. 2465.

[63] *Ibid.,* p. 2456.

[64] *Commercial Appeal,* March 8, 1945.

[65] *Ibid.,* April 5, 1945.

[66] *Ibid.,* April 16, 1945.

[67] *Ibid.,* March 27, 1945.

[68] Mississippi River Commission, *Stages of the Mississippi, 1945,* p. 27.

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[1] *Annual Report of 1946*, p. 7; *Commercial Appeal*, July 14, 1946.

[2] *Ibid.*, November 3, 1945.

[3] Memphis Engineer District, *Memphis Harbor Project*, p. 5.

[4] Moore, *Improvement of MR&T*, p. 186.

[5] *Commercial Appeal*, October 3, 1946.

[6] *Ibid.*, October 18, 1946.

[7] *Ibid.*, November 3, 1946.

[8] *Ibid.*, November 13, 1946.

[9] *Ibid.*, November 27, 1946.

[10] Moore, *Improvement of the Lower Mississippi and Tributaries*, p. 61.

[11] *Annual Report of 1946*, p. 2680.

[12] *Ibid.*, p. 2667.

[13] *Commercial Appeal*, January 11, 1947.

[14] *Ibid.*, February 10, 1947.

[15] *Ibid.*, July 8, 1947.

[16] *Ibid.*, July 17, 1947.

[17] *Annual Report of 1947*, p. 1069.

[18] *Annual Report of 1948*, p. 9.

[19] *Ibid.*, p. 3003.

[20] *Ibid.*, p. 1185.

[21] *Ibid.*, p. 3021.

[22] *Commercial Appeal*, March 18, 1949.

[23] *Ibid.*

[24] Interview, Paul Brown, March 6, 1973; Interview, Sam Tucker, March 6, 1973, Interview, Ray Houston, October 18, 1972.

[25] *Annual Report of 1949*, p. 2687.

[26] *Ibid.*, p. 1091.

[27] *Ibid.*, p. 2697.

[28] *Ibid.*, p. 2681; *Memphis Commercial Appeal*, March 25, 1949.

[29] *Ibid.*, p. 2687.

[30] *Annual Report of 1950*, p. 2780.

[31] *Ibid.*, p. 2768.

[32] *Ibid.*, p. 2773.

[33] *Ibid.*, p. 1114.

[34] *Ibid.*, p. 2769.

[35] *Commercial Appeal*, January 18, 1950.

[36] *Ibid.*, January 19, 1950.

[37] *Annual Report of 1950*, p. 356.

[38] *Annual Report of 1951*, p. 60.

[39] *Annual Report of 1953*, p. 7.

[40] Senate *Document No. 88*, 81st Congress, 1st Session (1949), p. 14.

[41] House *Document No. 485*, 81st Congress, 2nd Session (1950), p. 24.

[42] House *Document No. 132*, 81st Congress, 1st Session 1949), p. 7.

[43] *Annual Report of 1951*, p. 901.

[44] *Ibid.*, p. 907.

[45] *Ibid.*, p. 2434.

[46] *Ibid.*, p. 2465.

[47] *Ibid.*, April 12, 1952.

[48] *Ibid.*, August 1, 1952.

[49] *Annual Report of 1952*, p. 2351.

[50] Each square equals 10x10 feet, or 100 square feet.

[51] *Commercial Appeal*, January 3, 1953, *Annual Report of 1952*.

[52] *Commercial Appeal*, August 29, 1953.

[53] Clark to Colonel Charles T. Williams, October 10, 1968.

[54] *Annual Report of 1953*, p. 2057.

[55] *Commercial Appeal*, October 11, 1953.

[56] *Annual Report of 1953*, p. 2031, *Annual Report of 1954*, p. 1589.

[57] Clark to Williams, October 10, 1968.

[58] *Commercial Appeal*, October 8, 1954.

[59] *Annual Report of 1954*, pp. 1611, 1615.

[60] *Ibid.*, p. 1599.

[61] *Commercial Appeal*, October 3, 1954.

[62] House *Document No. 183*, 83rd Congress, 1st Session (1953), p. 19.

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[64] *Annual Report of 1955*, pp. 1633, 1642, 1647.

[65] *Annual Report of 1956*, p. 1881.

[66] *Ibid.*, pp. 1866, 1874.

[67] Mississippi River Commission, *Stages and Discharges of 1956*, p. 28.

[68] *Ibid.*

[69] *Commercial Appeal*, December 18, 1956.

[70] *Ibid.*, August 13, 1957.

[71] *Annual Report of 1957*, p. 1865.

[72] *Ibid.*, p. 1881.

[73] Colonel William P. Jones, Jr. to Colonel Charles T. Williams, November 12, 1968.

[74] *Ibid.*, p. 1881.

[75] *Commercial Appeal*, April 16, 1958.

[76] *Annual Report of 1958*, p. 46.

[77] Senate *Document No. 26*, 85th Congress, 1st Session (1957), p. 4.

[78] House *Document No. 76*, 85th Congress, 1st Session (1957), p. 21.

[79] *Annual Report of 1958*, p. 1883.

[80] *Annual Report of 1959*, pp. 1928, 1937, 1950.

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[1] *Commercial Appeal*, August 14, 1960.

[2] *Annual Report of 1960*, p. 1931.

[3] *Ibid.*, p. 1958.

[4] *Ibid.*, p. 626.

[5] *Ibid.*, p. 1941.

[6] *Annual Report of 1961*, p. x.

[7] *Ibid.*, p. 2048.

[8] *Ibid.*, p. 2009.

[9] *Commercial Appeal*, October 6, 1961.

[10] *Annual Report of 1961*, p. 2024.

[11] Texas-deck refers to a third deck that can be used for accommodations. Many towboats have a third deck, but it only contains the pilot house.

[12] *Commercial Appeal*, April 20, 1961.

[13] *Ibid.*, September 28, 1961.

[14] MRC, *Stages and Discharges of the Mississippi River* (1961), p. 30.

[15] *Commercial Appeal*, May 18, 1961.

[16] *The Military Engineer* (Nov-Dec 1961, Vol. 3, No. 356), p. 441.

[17] *Commercial Appeal*, January 18, 1962

[18] *Annual Report of 1962*, pp. 2063, 2064, 2071.

[19] *Ibid.*, p. 2081.

[20] *Commercial Appeal*, January 28, 1962.

[21] *Ibid.*, August 11, 1962.

[22] *Ibid.*, March 10, 1963.

[23] *Ibid.*, December 24, 1963.

[24] *Annual Report of 1963*, pp. 1824, 1808.

[25] *Ibid.*, p. 1819.

[26] *Commercial Appeal*, August 30, 1964.

[27] MRC, *MR&T Project Review*, Vol. 3, p. 19.

[28] *Ibid.*, p. 1.

[29] *Ibid.*, pp. 65-66.

[30] *Commercial Appeal*, April 23, 1964.

[31] *Annual Report of 1964*, pp. 1656, 1662, 1669.

[32] *Ibid.*, p. 1656.

[33] Moore, *Improvement of MR&T*, p. 142.

[34] *Ibid.*, p. 143.

[35] *Ibid.*, p. 150.

[36] *Ibid.*, p. 126.

[37] *Commercial Appeal*, July 18, 1965.

[38] *Ibid.*, October 23, 1965.

[39] *Annual Report of 1965*, p. 1596.

[40] *Ibid.*, pp. 1597, 1620.

[41] *Commercial Appeal*, February 11, 1966.

[42] *Anderson*, Houseboat, *p. 160.*

[43] Memphis Engineer District, *Stages and Discharges* (1966), p. 20.

[44] *Commercial Appeal*, October 20, 1966.

[45] *Ibid.*, October 4, 1966.

[46] *Annual Report of 1966*, pp. 1702, 1736.

[47] *Ibid.*, p. 1724.

[48] *Ibid.*, p. 1730.

[49] *Commercial Appeal*, January 5, 1969.

[50] *Ibid.*, April 2, 1967.

[51] *Annual Report of 1967*, pp. 1650, 1651, 1671, 1672, 1677, 1683.

[52] *Annual Report of 1968*, pp. 1771, 1772.

[53] *Memphis Press-Scimitar*, October 24, 1968.

[54] *Annual Report of 1968*, pp. 463, 1247, 1254, 1276.

[55] *Annual Report of 1969*, pp. 1272, 1278, 1279.

[56] *Commercial Appeal*, February 1, 1969.

[57] *Memphis Press-Scimitar*, April 15, 1969.

[58] Douglas, "The Public Be Damned," *Playboy*, p. 182.

[59] Flood Control Hearings, 91st Congress, 2nd Session (1971), p. 149.

[60] Senate Hearing, 92nd Congress, 2nd Session (1973), p. 36.

[61] Public Law 91-611, 91st Congress, H. R. 19877, December 31, 1970, Section 207.

[62] *Annual Report of 1970*, p. 1239.

[63] *Ibid.*, p. 1256.

[64] *Ibid.*, pp. 1250-1251.

[65] Senate Hearing, 92nd Congress, 1st Session (1971), p. 7.

[66] Senate Hearing, 92nd Congress, 2nd Session (1972), p. 25.

[67] *Memphis Press-Scimitar*, September 9, 1971.

[68] *Annual Report of 1971*, pp. 42-30, 42-31.

[69] *Ibid.*, p. 13-1.

[71] Construction News, January 31, 1973; Memphis *Commercial Appeal*, January 9, 1972.

[74] Hume, *Ibid.*

[75] Rhodes, "The Mississippi," *Playboy*, 297.

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[96] *Commercial Appeal*, February 20, 1973.

[97] *Ibid.*, March 18, 1973; Memphis *Press Scimitar*, March 17, 1973; *Dyersburg State Gazette*, March 21, 1973.

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[109] After Action Report, Charleston Sector

[110] LMM(OT), 192, December, 1973.

[111] Post Flood Report, 1973; Planning Section, July 29, 1973.

[112] *Waterways Journal*, September 27, 1947; *Ibid.*, May 15, 1948; *Ibid.*, April 4, 1974; *Ibid.*, April 20, 1974; *Memphis Commercial Appeal*, March 6, 1948; *Southern Living*, May 1970; *S&D Reflector*, June, 1974; Interview Jack Custer, January 30, 1975.

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District Engineers
1882 – 1976

	FIRST DISTRICT	SECOND DISTRICT
Capt. James B. Quinn	-1882	
Capt. John G. D. Knight	1882-1885	
Capt. A. M. Miller		1882-1884
Capt. C. B. Sears		1884-1885
Capt. Smith S. Leach	1885-1888	1885-1888
Capt. W. T. Rossell	1888-1888	1888-1888
Capt. Smith S. Leach	1888-1890	1888-1890

FIRST AND SECOND DISTRICTS

Capt. S. W. Roessler	1890-1895
Capt. Graham W. Fitch	1895-1897
Capt. Mason M. Patrick	1897-1898
Capt. E. E. Winslow	1898-1902
Capt. E. W. Van C. Lucas	1902-1905
Capt. Wm. D. Connor	1905-1908
Capt. Gustave R. Lukesh	1908-1908
Maj. M. L. Walker	1908-1910
Capt. Clarke S. Smith	1910-1912
Maj. E. M. Markham	1912-1916
Maj. Michael J. McDonough	1916-1917
Lt. Col. G. P. Howell	1917-1917
Asst. Engr. Montgomery Gardner	1917-1919
Maj. John N. Hodges	1919-1923
Capt. George J. Richards	1923-1923
Maj. Donald H. Connolly	1923-1928
Lt. Col. F. B. Wilby	1928-1928

MEMPHIS ENGINEER DISTRICT

Lt. Col. F. B. Wilby	1928-1931
Maj. Brehon B. Somervell	1931-1933
Maj. W. M. Hoge	1933-1935
Lt. Col. Eugene Reybold	1935-1937
Maj.-Lt. Col. Daniel Noce	1937-1940
Lt. Col. James D. Andrews, Jr.	1940-1941
Col. Jarvis J. Bain	1941-1943
Col. G. W. Miller, CE, AUS	1943-1945
Col. B. M. Harloe, CE	1945-1947
Col. E. P. Lock, Jr.	1947-1947
Col. L. H. Foote	1947-1952
Col. A. F. Clark, Jr.	1952-1954
Col. E. B. Downing	1954-1957
Col. Wm. P. Jones, Jr.	1957-1959
Col. M. L. Jacobs	1959-1962
Col. Edmund Kirby-Smith	1962-1964
Col. James A. Vivian	1965-1968
Col. Charles T. Williams	1968-1970
Col. John V. Parish, Jr.	1970-1973
Col. A. C. Lehman	1973-1976
Col. R. W. Lockridge, Jr.	1976-1979
Col. W. H. Reno	1979-1981
Col. J. F. Hatch, Jr.	1981-1984
Col. D. F. Means	1984-

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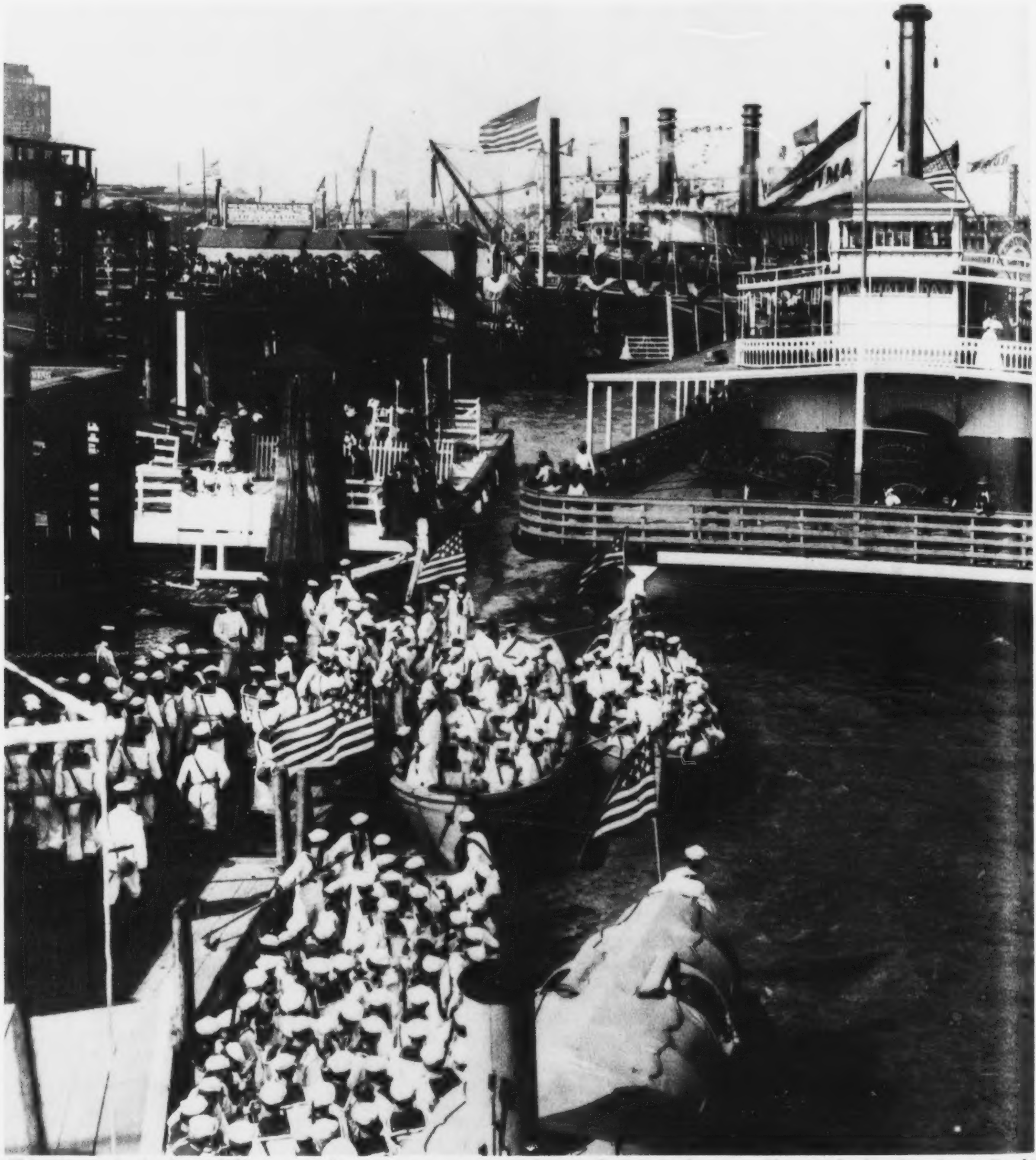


This picture is the last of the series taken to commemorate a famous Presidential voyage. Here at the Poydras Street Dock, New Orleans, Louisiana, President Taft submits to a welcoming ceremony.

Into the Second Century

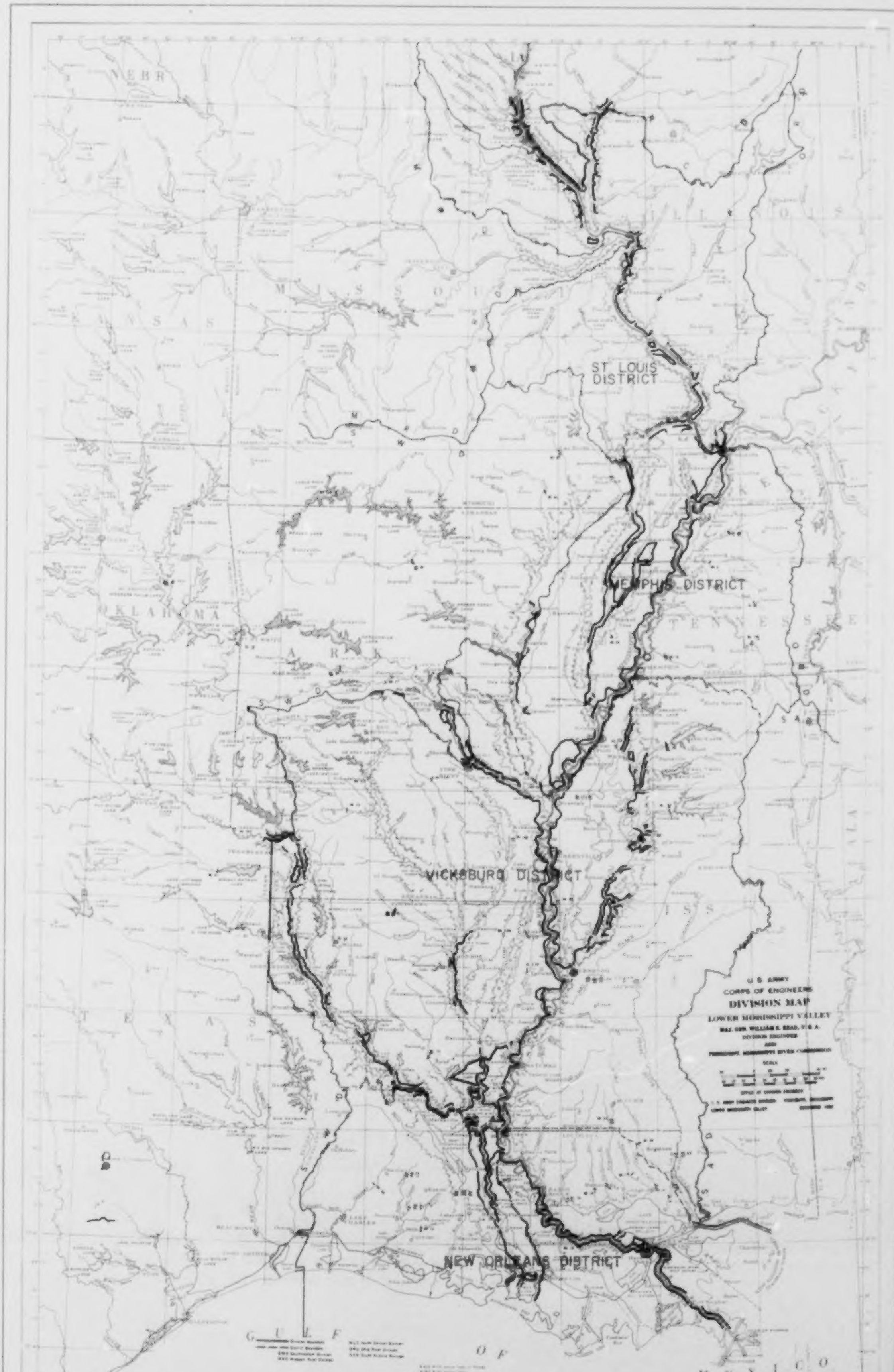
MEMPHIS ENGINEER DISTRICT, 1976-1981

By

Bobby Joe Williams

ESSAYONS
ESSAYONS

U.S. ARMY CORPS OF ENGINEERS
MEMPHIS DISTRICT
June 1986


U S ARMY
CORPS OF ENGINEERS
DIVISION MAP
LOWER MISSISSIPPI VALLEY
DIVISION ENGINEER
AND
SCALE
ST LOUIS DISTRICT
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TEXAS
GULF OF MEXICO

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PREFACE

This is a history of the Memphis Engineer District. It brings up to date *A Century on the Mississippi* published in 1976. Memphis Engineer District is celebrating a century of work in the Memphis vicinity and the author wishes to thank the Corps of Engineers for allowing me to be a part of the celebration.

In the completion of this work, I want to thank the many people of the Memphis District that helped in so many ways to make the research and writing easier. I want to give special thanks to Mr. Ray Houston, Mr. Pat Flaherty, Ms. Betty Ferguson, Dr. Martin Reuss, and Miss Anne Ruth Coleman. Though others may argue with some of the conclusions in this history, the author takes full responsibility.

Dedicated
To
Dennie and Abby

CHAPTER I

The Mississippi River and the Engineers

The Mississippi River's size and force have always challenged man. Starting as a small stream out of Lake Itasca in central Minnesota, the river begins a 2,340-mile journey to the Gulf of Mexico. In making the long journey, the river receives the drainage of all or part of 31 states comprising about 1,245,000 square miles—41 percent of the United States. Controlling this mighty river has become one of the most important tasks of the United States Army.[1]

The shifting currents, sandbars, snags, and other navigation obstacles made journeying the Mississippi a hazardous adventure. When steamboat travel began on the Mississippi in the early nineteenth century, it became clear that this great commercial route must be cleared of natural obstructions. Improvement of navigation on the Mississippi received its first direct appropriation from the federal government in the River and Harbor Bill of 1824. President James Monroe was authorized to spend up to $75,000 for snagging operations on the Ohio River and the Lower Mississippi. The President gave the Corps of Engineers the responsibility for clearing the river.[2]

Other than the shifting channel, snags in their many forms (snags, sawyers, and planters) were the main obstacles to navigation. Snagging operations became more efficient with the development of a workable snagboat by Henry Shreve. The Corps of Engineers adopted Shreve's newly designed snagboat for its snagging operations. The meager federal appropriations reflected the belief of Congress that improvement of navigation on the Mississippi was not primarily a federal responsibility. Yet, the first funds actually showed that Congress did accept some federal responsibility.

Still, steamboat traffic on the Mississippi increased dramatically. New Orleans recorded 2,300 steamboat landings in 1834—just 10 years after the first appropriations were made for snagging.[3] States along the river were hard pressed to find the funds necessary for improvements. So-called River Conventions in many cities affected by the Mississippi began to call the problem of navigation a national problem.

In 1845 Memphis hosted a River Convention attended by many well-known political figures of the time, including John C. Calhoun.[4] This

City of Memphis from the waterfront in 1914.

convention, followed by others, began to stress not just navigation improvements but levees for flood control, designed and paid for by the federal government. Of course, levees for navigation improvement were stressed, but protection from floods was also important. Such conventions began removing doubts about the Mississippi being a local problem.

Responding to public pressure, Congress passed two Swamp Lands Acts in 1849 and 1850. The acts transferred to most of the states along the Lower Mississippi "swamp and overflow land" on condition that proceeds from the sale of the land be used to build levees and drainage channels to develop the areas.[5]

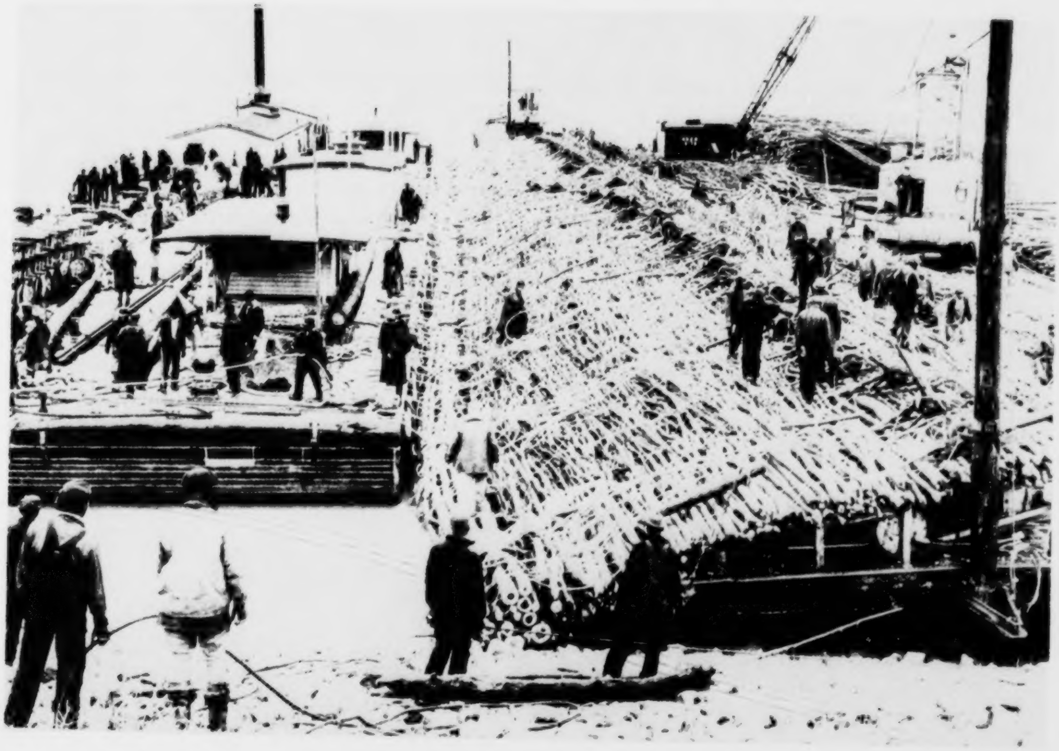
Though levees proved useful to control floods, Congress, fearing it lacked constitutional authority, refused to consider flood control measures, but did authorize additional surveys. One such survey, completed in 1861 by Captain A. A. Humphreys and Lieutenant Henry L. Abbot, two Topographical Engineer officers, was the most extensive report on the Mississippi until that time.[6] Full of new data and theories, the survey is a milestone in hydraulic engineering. The authors concluded that "levees only" could control the Mississippi. The Civil War prevented further construction of levees however. In fact, during the Civil War the northern armies destroyed most of the small levees while retreating southern armies often tried to clog the channel to deny its use to the enemy. By the end of the war the levees required extensive work to repair the damage. During the late 1860's and the 1870's, the federal government dredged the river extensively, restoring it as the United States' primary commercial waterway.

One of the most significant events in the history of the Lower Mississippi Valley took place in 1879. After the flood of 1874 Congress appropriated funds for another survey of the Mississippi and in the same year federal legislation authorized a commission to study the lower river basin. Three of the five-member commission were Corps of Engineers officers. The Commission recommended a permanent Board of Engineers to design a comprehensive plan for improvement of the river. Debates about river improvement continued. One issue was local versus national responsibility for river improvement. Another issue was should the Corps of Engineers or some other agency be given the responsibility for navigation improvements. In 1879 Congress provided for the creation of a Mississippi River Commission.[7] Significant improvement of the Mississippi River began with the River Commission.

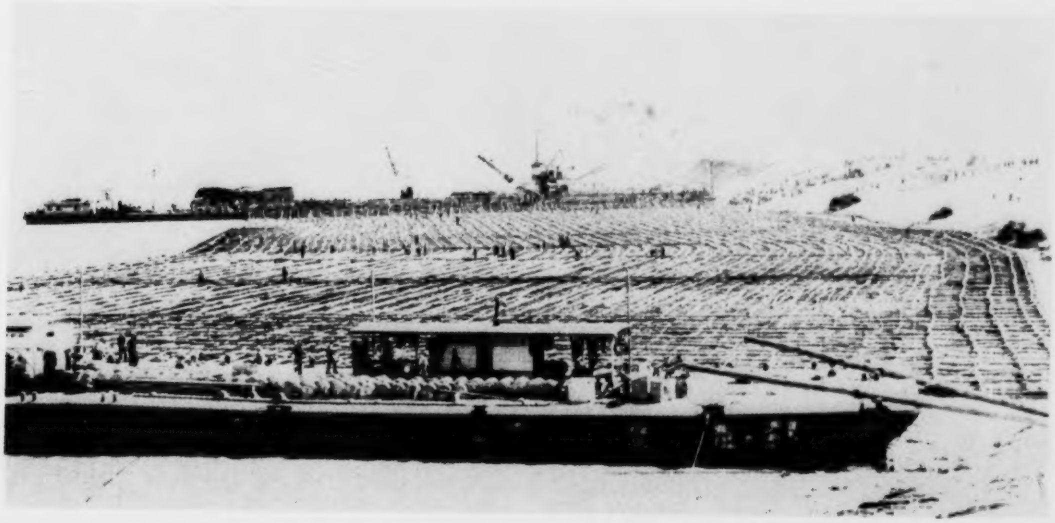
The Mississippi River Commissio~~n, as re~~quired by Congress, was composed of seven members appointed by the President and confirmed by the United States Senate. The President of the Commission and two other members had to be selected from the officers of the Corps of Engineers. One member from the U.S. Coast and Geodetic Survey and three from civilian life, including two civil engineers, completed the seven-member River Commission. General Q. A. Gillmore was appointed President of the Commission and the headquarters was located in St. Louis.[8]

The mission of the Mississippi River Commission was the improvement of navigation, protecting the river banks, and preventing disastrous floods. In the early years the River Commission could officially only use its funds to improve navigation. Levees were designed to confine the channel to predetermined locations. Water confined by levee scoured the bottom of the river resulting in improved navigation. Of course, the levees also provided much needed protection of riparian lands. Not until 1917 were there direct appropriations for flood control.

Until 1882 the River Commission planned and carried out various projects for river improvement. The River and Harbor Act of 1882 divided planning and work into separate operations. Henceforth, planning was to be the responsibility of the Mississippi River



Willow mattress plant and mooring barge being swung into position.



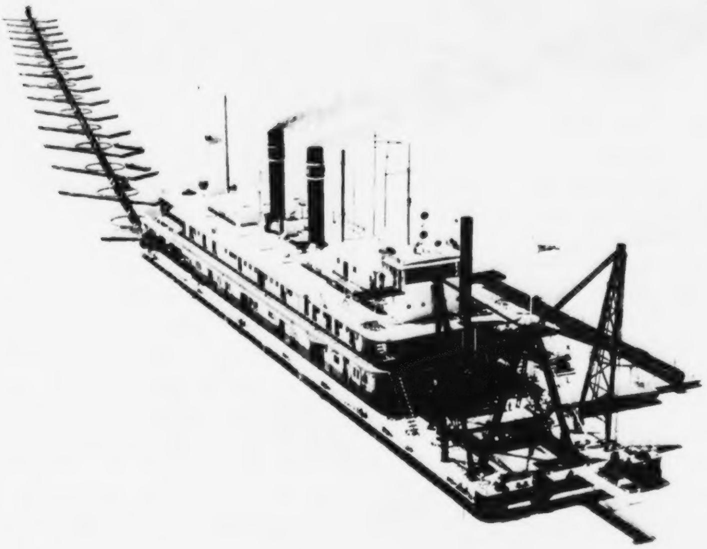
Woven willow mats were used for riverbank protection, October 1939.

Commission and actual work carried out by the Corps of Engineers.

Initial meetings of the Mississippi River Commission established the headquarters at St. Louis, but the Commission's authority covered the area south of Cairo, Illinois. From Cairo the Lower Mississippi drains approximately 921,960 square miles. The Mississippi River Commission divided the river below Cairo into four Engineer Districts. First District headquarters was located in Cairo initially, but in 1885 it was moved to Memphis, Second District at Memphis, Third District at Vicksburg, and Fourth District at New Orleans. Until 1928 the First and Second Districts shared the same District Engineer. A reorganization in 1928 resulted in combining the First and Second Districts and renaming the Districts after their headquarters: Memphis, Vicksburg, and New Orleans. Also, the Corps moved the headquarters of the Mississippi River Commission from St. Louis to Vicksburg.[9]

Navigation improvement was the major mission of the Mississippi River Commission. It was generally recognized that most of the navigation problems could be traced to bank

Severe bank caving in Memphis, July 26, 1926.



Dredge Ockerson was put into service in 1932.

caving. The Mississippi River is a meandering stream shifting its course from time to time. A study of the river has determined that the Mississippi at various times has relocated itself as many as 26 times within an area 50 miles wide.[10] Meandering of the channel puts enormous pressure on the soft alluvial banks resulting in prodigious erosion. Deposits of such magnitude affect navigation of the river. The River Commission recognized that every mile of bank along the river could not be protected; it was not economically feasible. Therefore the Commission selected strategic locations for protection. Port cities along the river received the first protection. In the early years of the Commission, Memphis, which had severe problems from caving banks, benefited from this policy.

The Mississippi River Commission thought that revetment and levees would confine the Mississippi to a specific channel and the scouring action of the current would eliminate sandbars. A 10-foot channel could thus be maintained, the Commission calculated, though periodic dredging would be necessary. Early dredging had been accomplished by dragline and bucket. In 1891, the River Commission began experimenting with hydraulic dredges which sucked the sediment to the surface where it was placed on barges to be hauled to dumping sites. Later, the development of the floating discharge pipe allowed the dredged material to be carried to a fill area or outside the channel. By 1901 the Mississippi River Commission had a fleet of nine dredges.

Two types of dredges are still in use by the Mississippi River Commission. The dustpan dredge operates just as the name implies—scooped-up sediment is deposited elsewhere by discharge pipes. Cutterhead dredges are used on harder material, but the process is essentially the same. A large drill-like cutterhead cuts through the material and it is carried by discharge pipes to other areas. Though the process has been refined over the years, dredging remains one of the most important tools in maintaining the channel of the Mississippi.

The Mississippi River Commission might have had its authority limited to navigation work forever had not several flood disasters forced Congress to open the federal treasury. The first such disaster occurred in 1882.

CHAPTER II

River Control Federal Style

The great flood of 1882 reminded people of the Lower Mississippi Valley of their continued dependence on the vagaries of nature. During the period between January and March 1882, more than 235 billion cubic yards of rain fell over the Mississippi and its tributaries. Although the river was never more than a few feet above flood stage, it did a great deal of damage. Levees were non-existent in some areas and inadequate in others. Residents across from Memphis cut holes in the roofs of their homes to find a safe and dry place. For a distance of 17 miles west of Memphis water was 4 to 11 feet deep. Crevassed levees were the norm. There were 284 crevasses with an aggregate length of 83 miles.[1] The crevasses extended almost the entire length of the Mississippi, and the water inundated an extensive area. Though no reliable figures of acreage inundated were kept, it was stated that a steamboat could have traveled from near Pine Bluff, Arkansas, to the Gulf without entering the Mississippi River.

Federal and state reluctance to provide funds for flood control compelled local residents along the river to tax themselves for levee construction through local "levee boards." Before 1900 the states of Louisiana, Mississippi, Arkansas, Missouri, and Tennessee expended more than $64,000,000 on levee construction.

Local levee construction occurred in the area across from Memphis called the St. Francis Basin. The St. Francis Basin includes the southern part of Missouri and almost the entire length of Arkansas along the Mississippi River. In Arkansas levees were constructed during the years between 1851 and 1858. The levees averaged 3 feet in height and numerous gaps existed in the line. Along the river in Missouri levee work began as early as 1854. Approximately $250,000 was expended prior to the great flood of 1858. Most of the levees were destroyed by the flood. For approximately 30 years little was done to protect the citizens of eastern Arkansas and Missouri.

In 1887 the Arkansas legislature adopted a law providing for levee districts. The following year the Mississippi River Commission passed a resolution allotting $5,000 to survey the St. Francis front to determine the best possible location for a levee. The survey was completed in the spring of 1889. Small sums were spent on levees in the area, but determined efforts did not get under way until 1893.

The Arkansas portion of the St. Francis Basin was formally organized into a levee district in February 1893. The area in Missouri was organized the following month. Almost immediately the Memphis Land and Timber Company challenged the Lower St. Francis Basin Levee District in the courts of Arkansas. The company owned large tracts of land in Mississippi County, Arkansas, and objected to the law creating the levee district and the tax imposed by the levee board. Arkansas courts ruled in favor of the levee district. Farmers of Lauderdale and Tipton counties across the river in Tennessee asked their representatives in Congress to use their influence to halt the project. They argued that the St. Francis levee would throw all the water into Tennessee and destroy their farm land. Construction of the levee continued and so did the protest for a number of years. Eventually all legal challenges were defeated and most of the people of eastern Arkansas accepted levees for flood control.

By 1897 the St. Francis levee in Arkansas was completed from some 40 miles north of Memphis to the Missouri state line. Much of the area across from Memphis was unprotected except where private land owners had constructed levees. Part of the levee was only 12 years old and had never felt the effects of

Snagboat Horatio G. Wright docked at Memphis waterfront around 1910. Note other modes of transportation.

flood waters. Ready or not, the levees experienced their first serious test in 1897.

The Mississippi River was out of its banks in March. Eye-witnesses reported that a person could travel from Memphis to Crowleys Ridge in Arkansas in a skiff, a distance of about 40 miles. Residents organized levee patrols with one man to every 3 to 5 miles. The men reported serious problems, but attempted to repair small leaks. People on the side of the river not protected by levees sometimes crossed over to cut the levee so that the flood waters would go into Arkansas rather than Tennessee. Levee cutters took a piece of barbed wire, and using it like a saw, cut a small trench to the level of the water. As the water trickled through the trench it would gradually widen to create a crevasse. By the time the crevasse was discovered the culprits were usually long gone. If they were caught by levee patrols no embarrassing questions were asked about their sudden demise.

In March 1897, flood waters covered most of Mississippi, Poinsette, Cross, St. Francis, Crittenden, and Lee counties in Arkansas. Residents on Presidents Island south of Memphis suffered in water from 1 foot to neck deep. Several people drowned there, and 12 were reported in Marion, Arkansas. The total number of deaths was placed at 70, but no one knows whether that figure is accurate. Nearly 50 towns suffered from inundation, and approximately 60,000 people incurred property damage. In spite of the devastation no levee constructed by the Corps of Engineers had failed. Well-constructed levees proved to be effective in holding back the mighty waters of the Mississippi.

Levee districts along the Mississippi renewed the work of completing the levees. By 1904 the Mississippi River Commission had expended about $57,000,000 on levees that reached a length of 1,500 miles. A few years later the back-to-back flood disasters of 1912 and 1913 focused attention once again on levees for flood control.

Consecutive flood years on the Mississippi are unusual. Major problems occur because the damage of the first flood has not been repaired because of lack of time. Such was the case in 1912 and 1913. In late March 1912, the river crested at 45.3 feet or about 5 feet higher than the previous high-water mark in Memphis in 1907. A second crest in April was lower, but still damaging. Crevasses occurred at Hickman, Kentucky; Caruthersville, Missouri; and at two places in the St. Francis levee across from

Memphis. Damages in west Tennessee were extensive, mostly from backwater flooding. In Memphis, the area north of the present Cook Convention Center sustained serious damage. A total of 714 houses and 25 manufacturing plants were under water at times. Total estimated damage was over $6.5 million. More than 49,000 feet of levee under the control of the Memphis District was destroyed. Most of the destroyed levees had been constructed by private interests.

Though some levees were destroyed, others withstood the flood with surprising success. The flood of 1912 demonstrated that the levees needed to be increased in height and strength. Nevertheless, experience had shown that the states along the Mississippi were unwilling, or unable, to bear the expense. The flood of 1912 came in an election year and the problems of flooding received extensive publicity. All three major political parties voiced support for flood control. Unfortunately for the Mississippi Valley, the promises were lost in the drive to adopt the progressive program of Woodrow Wilson. Though army units were used to repair part of the flood damage of 1912, there was inadequate time to repair crevassed levees before another disastrous flood occurred the following year.

The river crested twice during the flood of 1913. The first occurred in January and the second in April. Recognizing that a major flood was on the way, the Mississippi River Commission ordered Major Edward M. Markham of the Second District to raise the levees to protect against a flood stage of 46 feet. Approximately 300 teams were put to work raising the levees of the Lower St. Francis Levee District. Again, the northern part of Memphis suffered damage. The water flooded some 20 blocks and drove more than 1,000 families from their homes.

On April 9, 1913, the river crested at Memphis at 46.1 feet, but started dropping the next day. Nevertheless, great damage resulted from the flood waters. Second Engineer District levees suffered crevasses totaling almost 20,000 feet. Approximately 24 percent of the area subject to overflow in the District was flooded.

Soon after the flood of 1913 a group of citizens from Memphis established the Mississippi River Levee Association. By subscription the group raised $85,000 to support a campaign for better flood control. This group and others were rewarded by the Flood Control Act of 1917. Under terms of the law, levee construction for flood control was authorized for the first time, but local authorities were required to contribute at least one-third of the cost.[2]

Over the years the height, grade, and section of the levees had been improved. New grades and sections were adopted in 1914 to meet the record crests of 1913 along the river. Utilizing funds authorized in the 1917 act and subsequent legislation, the Second District completed 75 percent of its levees by 1923.[3]

Just after the flood of 1913 a serious problem, one that had been building since 1876, threatened the harbor facilities in Memphis. In 1876 Centennial Cut-off occurred above Memphis. The adjustments to the cut-off shortened the river by some 30 miles, but caused the river to carry sediment from Hopefield Point across to the Memphis waterfront where the sediment was deposited. The District Engineer made every effort to protect Hopefield, but changes in the channel caused an eddy to form in front of Memphis. A bar was formed, and by 1904 the area of the sandbar was about 100 acres at low water. The sandbar later became very familiar to Memphis—Mud Island.[4]

Each year the sandbar increased in size threatening to leave Memphis high and dry. Many expressed the belief that the Mississippi would reclaim its creation. Nevertheless, in 1915 the unwanted addition to Memphis was still there. A project to remove the bar was completed in 1917. A diversion channel some

Mud Island flooded in 1973.

Flooding at New Madrid, Missouri, in 1937.

3,000 feet long was dredged between the bar and landing, and Wolf River was diverted through the channel. The scouring effect of the current was to erode the bar until it was washed away. Current from the channel was too weak to have an appreciable effect on the bar, but by dredging the city did have harbor facilities.[5]

Another project to remove the sandbar was completed by the Corps of Engineers in 1921. By the use of dikes, revetment, and dredging, the project was designed to throw the current of the Mississippi against the bar. However, the effort proved futile. Dynamite was then used in an attempt to loosen the bar so that the current could carry it away. Mud Island remained a permanent fixture in the Memphis harbor.[6]

For almost 50 years the Mississippi River Commission and the Corps of Engineers had tried, and with some success, to tame the turgid Mississippi. At the end of 1926 the River Commission had completed more than 120 miles of revetment and had more than 1,800 miles of projected levees under its jurisdiction that were approximately 86 percent complete. In 1927 the work received its sternest test to that time.

The flood of 1927 was an economic disaster. Though the high water of 1937 reached greater stages, it did not produce the damages of the 1927 flood. Beginning on January 1, 1927, the Mississippi rose slowly to a crest of 37.7 feet at Memphis and began a slow decline. It rose to about the same level in early February and almost remained stationary. A third crest in April resulted in the flood water being against the levees for 107 days at Memphis. The first death occurred near Ridgely, Tennessee, but it was only the first of approximately 300 fatalities. Around 137,000 buildings and homes were destroyed or damaged. Total damage was placed at $236 million by the Mississippi River Flood Control Association. Clearly, some new actions were needed.

CHAPTER III

Mississippi River Caged; Not Tamed

Prior to 1927 the Mississippi River Commission had accepted the Humphreys and Abbot "levees only" policy of flood control. Occasionally hare-brained schemes were proposed, but quickly rejected. After serious debate, Congress passed the Flood Control Act of 1928 which abandoned the "levees only" for a more comprehensive plan. Though levees were to be enlarged and maintained, they were to be supplemented with floodways, spillways, and continuing channel improvements, including strengthening the main stem levees.

The 1928 act adopted the plan proposed by Major General Edgar Jadwin, Chief of Engineers. In the Memphis District the plan called for raising the levees along the main stem of the Mississippi and constructing a 5-mile-wide floodway from Birds Point to New Madrid in Missouri to protect the city of Cairo, Illinois.

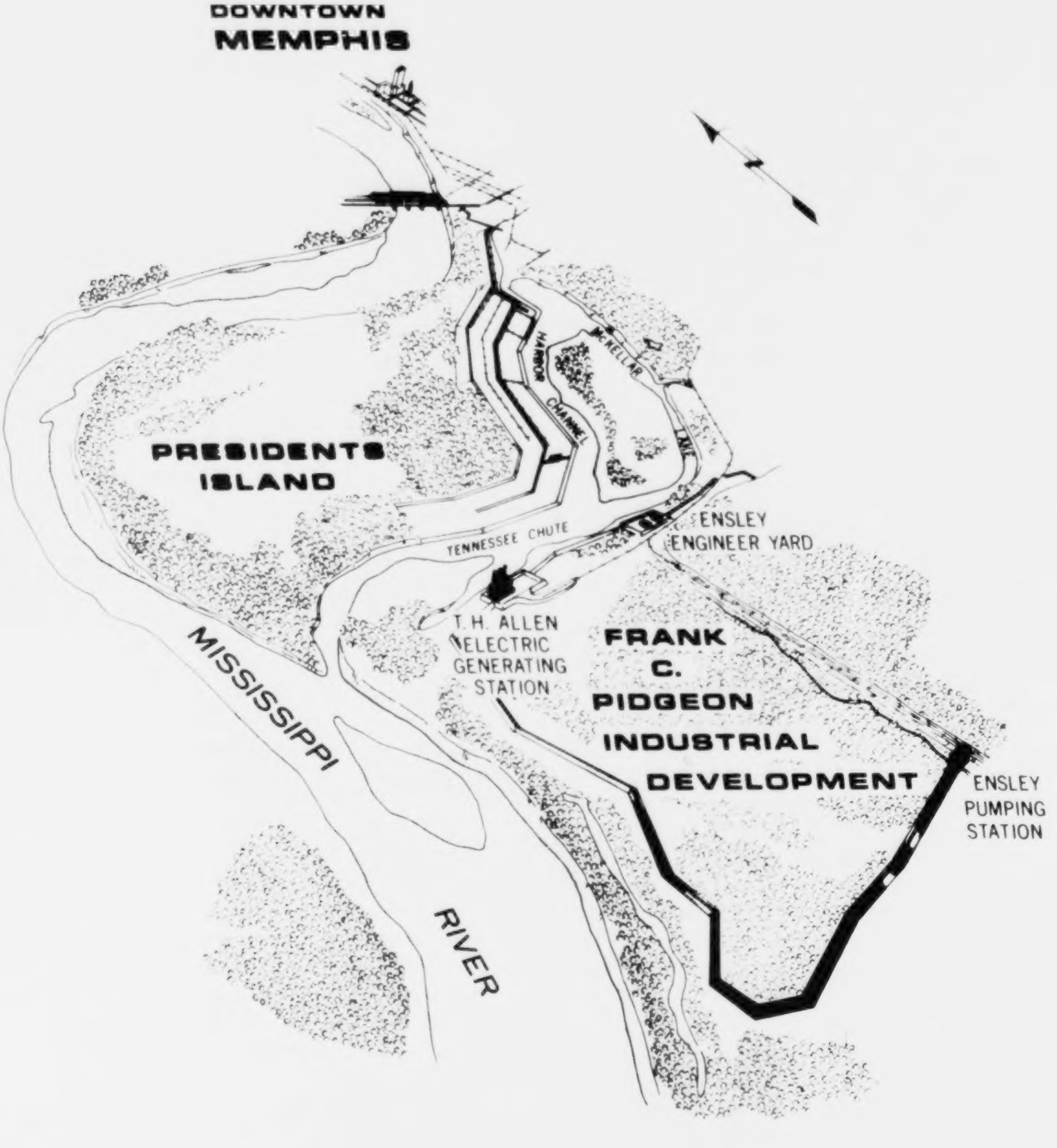
While preparing to undertake the new projects, the Memphis District renewed its efforts to protect the Memphis harbor facilities. In 1929 revetment was placed at several places and the local Harbor Commission began grading the river banks. The area in front of Memphis had long been an eyesore. A berm bank some 60 feet wide was used to relieve the pressure on the river bank. Local authorities decided to pave the berm and in 1935 Riverside Drive was dedicated — a welcome addition to the harbor area.[1]

Most of the 1930's was devoted to developing the various projects authorized in the 1928 Flood Control Act. Also, the Mississippi River Commission began constructing cut-offs for channel improvement. Before 1930 the Commission had rejected all plans for artificial cut-offs. A natural cut-off at Hard Times Bend below Vicksburg in 1929 resulted in Brigadier General Thomas H. Jackson, President of the Mississippi River Commission, ordering a study of the cut-off with the view that a program of cut-offs might be beneficial. Brigadier General Harley B. Ferguson replaced Jackson in 1932 and became the most outspoken proponent of cut-offs. The first of a series of cut-offs was completed in 1933 at Diamond Point. In 1942 the program of cut-offs came to an end with the Harding Cut-off. Though other cut-offs were studied, none were undertaken. The cut-off program resulted in a net shortening of the Mississippi River of approximately 114 miles.[2]

Flood control works initiated under authority of the Flood Control Act of 1928 were tested in the 1937 flood, in the truest sense a superflood. The Birds Point-New Madrid Floodway was placed in operation for the first and only time, and proved its effectiveness by reducing the stage at Cairo, Illinois, approximately 3.5 feet. District Engineer Colonel Eugene Reybold reported total damages of more than $6.2 million, but more important was the fact that all flood control devices in the district had worked satisfactorily.

No flood control works in the Memphis District failed during the flood of 1937. Therefore, Major Daniel Noce decided to concentrate on protecting the tributaries from backwater flooding. Controlling the tributaries would cut the flow into the Mississippi and give flood protection to adjacent areas. Flood control for the city of Memphis and the St. Francis River Project are examples of this kind of work.

Flood control plans for Memphis were included in the River and Harbor Act of 1937. The project was designed to give the city protection from overflow and backwater of Wolf River and Nonconnah Creek. Floodwalls, levees, reservoirs, and pumping stations were constructed to give the city protection from a projected flood of 54.5 feet on the Memphis gage.


DOWNTOWN
MEMPHIS
HARBOR CHANNEL
McKELLAR LAKE
PRESIDENTS ISLAND
TENNESSEE CHUTE
ENSLEY ENGINEER YARD
T.H. ALLEN ELECTRIC GENERATING STATION
FRANK C. PIDGEON INDUSTRIAL DEVELOPMENT
ENSLEY PUMPING STATION
MISSISSIPPI
RIVER

Memphis Harbor Project

The St. Francis River Project, authorized in the 1936 Overton Act that amended the Flood Control Act of 1928, called for a dam and reservoir, levees, floodways, a siphon, and channel improvements on the Tyronza River. The Wappapello Dam, completed in 1941, created a 625,000-acre-foot-capacity reservoir for flood protection below the dam. The area around the reservoir was transformed into a recreational complex. Another important feature of the St. Francis Project was the Marked Tree Siphon, which carries excess water over the levee and assures flood protection for the city of Marked Tree, Arkansas.

During World War II, work on the various flood control projects continued but at a reduced rate that reflected the priorities of war. Even as the war progressed and victory seemed possible, congressional committees adopted resolutions in March 1943 requesting the Chief of Engineers to review the navigational features of the Mississippi River and Tributaries Project. On February 14, 1944, the Chief of Engineers approved a report of the Mississippi River Commission that recommended modification of the project to include the authorization of a 12-foot-deep channel on the Lower Mississippi.[3] Congressional debate resulted in the adoption of the Flood Control Act of December 22, 1944, which authorized a complete stabilization of the lower river to provide a 12- by 300-foot navigation channel.[4]

World War II boosted river traffic. By the end of the year, Memphis had 36 river terminals, and river commerce was increasing. On February 15, 1946, Memphis District Engineer, Colonel B. M. Harloe, held a public hearing to determine the best plan for harbor improvement at Memphis. General Max C. Tyler, President of the Mississippi River Commission, recommended the so-called Tyler Plan. The Tyler Plan was authorized by the Flood Control Act of 1946. At an initial cost of more than $17 million, the Memphis Harbor Project included the closing of Tennessee Chute with a dam that created additional recreational facilities. Prior to the closing of Tennessee Chute the current of the Mississippi was split by Presidents Island just south of Memphis. Part of the flow, Tennessee Chute, went to the east of Presidents Island, but most of the current went to the west of Presidents Island. Tennessee Chute was closed and the slack water then was christened McKellar Lake in honor of the senior Senator from Tennessee, Kenneth D. McKellar. Part of Tennessee Chute was dredged and then used as a slack-water harbor on the east side of Presidents Island. A levee and pumping station protected another 6,800 acres for future industrial port development.

By 1950 the flood control project for the Lower Mississippi was approximately 60 percent complete. Almost $857 million had been expended since the adoption of the Flood Control Act of 1928. The Mississippi River Commission estimated that the expenditure had been cost effective because it had prevented about $5 billion in flood damages, a ratio of benefits to cost of more than five to one.

The Flood Control Act of 1950 provided Memphis District additional projects. These included the Cache River Basin Project, protection from floods for Des Arc, Arkansas, and protection from backwater flooding in the St. Francis Basin. Numerous other projects did not receive approval however.

Approval of a nationwide interstate highway system resulted in a major realignment of the Mississippi in the Memphis reach. As part of the system a new bridge across the Mississippi was recommended. Construction of the bridge at the proposed location presented major navigation problems. The Corps of Engineers proposed that before a bridge could be undertaken the river in front of Memphis needed to be stabilized. After approval, the Corps of Engineers began the project in 1956. Using dredging, bank protection, and dikes, the Corps

1973 flood at Memphis.

1973 flood at Caruthersville, Missouri.

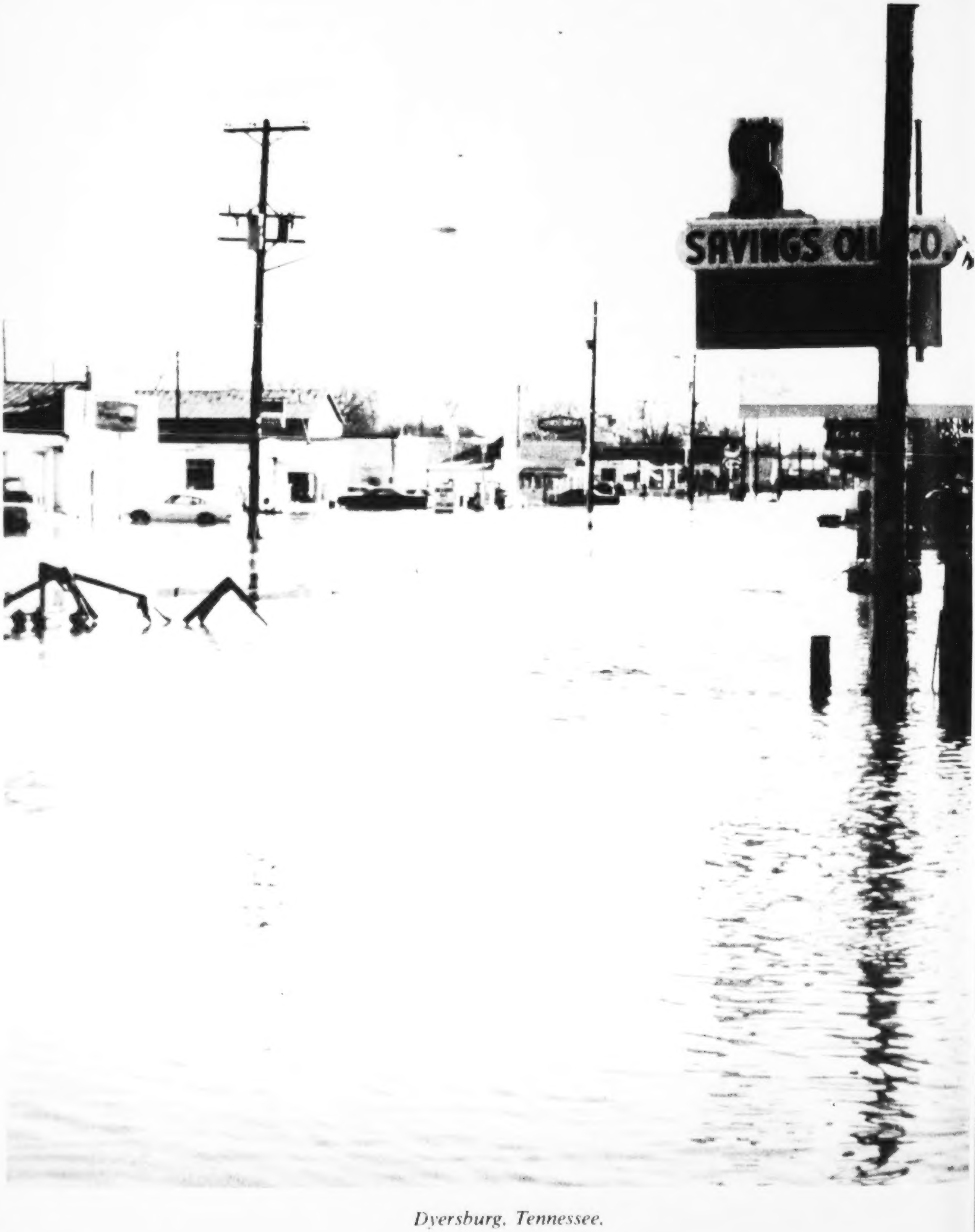
began stabilizing a 15-mile reach of the river. Engineers dredged a large western section of Mud Island and placed part of the spoil on the section of the island, raising the area 20 feet above the project flood. By the 1960's the project had progressed to a point that construction of the bridge could be started.

As the Mississippi River Commission approached its 85th year of operation, it was reported that about $1.5 billion had been expended on controlling the Lower Mississippi. Such expenditures were great, but they had prevented $7.2 billion in damages. The benefit-cost ratio had risen to seven to one. Still, the Corps of Engineers had to do more for floods continued to cost lives and destroy property.

In 1964 the Mississippi River Commission completed a congressionally authorized comprehensive review of the Mississippi River and Tributaries Project. The Corps recommended modifications and some were included in the 1965 River and Harbor and Flood Control Act. The act authorized a long-term plan designed to align the channel of the Mississippi into a predetermined location and hold it there through dredging, revetment, and contraction works. The purpose of the plan was to pave the way for the 12-foot channel that had been authorized several years before. To complete the project it was estimated that nearly 780 miles of revetment needed to be placed on the banks. During the next few years channel stabilization, rather than flood control, took a majority of the budget.

By the end of 1972 the project was well underway. In Memphis District the Army Corps of Engineers had completed more than 1.6 million linear feet of revetment and 486,950 linear feet of dikes. Levees were almost completed to the adopted grade and section. Less than 90 miles of the approximately 1,175 miles of authorized levee still needed additional work.

Floods of 1973 and 1975 sorely tested the flood control structures. The Mississippi River set a record for days-out-of-bank in 1973, 62 consecutive days. Flood control structures performed magnificently, though a few privately constructed levees did fail. In all, the Mississippi River and Tributaries Project prevented damages estimated at more than $7.2 billion. Flooding in 1975 was not as severe, but some 500 people were forced from their homes. Clearly the Corps of Engineers had played a significant part in controlling the Mississippi River during the first century of the Mississippi River Commission; but much more needed to be done. The second century of work was about to commence.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CHAPTER IV

Into the Second Century

The Memphis Engineer District began its second century of work on the Mississippi in 1976. Colonel Albert C. Lehman, Memphis District Engineer, accompanied the Mississippi River Commission on its annual high-water inspection trip from Cairo, Illinois, to the Head of Passes. Major General Frank P. Koisch, Mississippi River Commission President, conducted the 298th meeting of the River Commission, and he reported that the Mississippi Valley had experienced one of the calmest springs in years. Though stream flow conditions in the last quarter of 1975 had alarmed river watchers, lack of inflow from the northern tributaries produced a stage of only 42 feet at Cairo, Illinois. The normal crest stage at Cairo is about 5 feet above the crest of 1976.[1]

During fiscal year 1975 the Mississippi River Commission awarded about 100 construction contracts worth about $105 million, but when the number of contracts was added to those already under way, the total was 205 items worth $295 million. Major General Koisch revealed that in fiscal year 1976 the Mississippi River Commission intended to award another 231 items with a value of $157.9 million.[2]

According to the River Commission, the main stem levees needed additional work because the flood of 1973 indicated that the levees were not capable of carrying the project flood with the authorized freeboard. After the flood of 1973, a program to raise the levees was undertaken. By March 1976, the River Commission had awarded contracts for raising 362.9 miles of levee, and in fiscal 1976, the Commission planned to award an additional 15 miles during the transition quarter. Even with the work under way, there were more than 500 miles of levee that required raising, and another 564.3 miles of levee awaited construction.[3] The President of the Mississippi River Commission reported that it required an additional $925 million to complete the work in a reasonable period of time.

In past years levees had demonstrated their effectiveness as a flood control measure. In subsequent years they were required to demonstrate that ability again, because in the Memphis District there is about a 50 percent chance that the Mississippi River will be out of its banks each year.[4] There was serious flooding in 1973 and 1975 along the Lower Mississippi, but the Memphis District had more to worry about because of other rivers within the District. Major flooding often occurred on the St. Francis River in Arkansas and Missouri. Other rivers with potential flood problems in the District were the Cache, White, Black, and Tyronza rivers in Arkansas. In west Tennessee the Obion, Forked Deer, and Wolf rivers and Nonconnah Creek might cause serious flood problems. In western Kentucky several minor streams often flooded surrounding areas. The Memphis District had projects planned or under way on most of the streams, but a great deal of work remained to be done. Most of the waterways, including the Mississippi, caused serious problems for the Memphis District in 1979.

On March 6, 1979, the National Weather Service reported that snowmelt and heavy rains in the Ohio and Upper Mississippi valleys would cause the Mississippi to spill out of its banks at most locations along the lower Mississippi.[5] The Weather Service predicted a crest of 36.5 feet for Memphis, and 54.1 feet for Cairo, Illinois. Serious problems had already developed in southeast Missouri where small levees on the Floyd Livingston and Bob Walls farms crevassed causing the Black River to flood Highway 53 south of Poplar Bluff, Missouri.[6]

Mississippi River stages north of Memphis caused the Memphis District to go into Phase I operations of its Flood Emergency Activities

Plan on March 5, 1979. Under Phase I the Corps does not take direct control of the flood-fighting operation, but provides assistance to local flood-fighting organizations, including levee patrols.[7] The area under Phase I included the west side of the Mississippi from Cape Girardeau, Missouri, south to the Arkansas-Missouri state line, and on the east side of the Mississippi, from the Illinois levee near Mound City and Cairo, Illinois, south to the Hatchie River in west Tennessee.

Corps of Engineers personnel established headquarters in Cairo, Illinois; Caruthersville, Missouri; and the Reelfoot-Obion areas in west Tennessee to monitor flood control structures. Under Phase I operations the Memphis District provided assistance to local levee and drainage officials. Levee slides, wave wash, sandboils, and seepage were the most serious problems encountered, and Corps personnel furnished polyethylene, sandbags, and pumps to local officials to combat these minor flood problems.

Along the Mississippi, most people living inside the main stem levee began to evacuate after securing their homes and farm equipment. Farm machinery and animals were moved to higher ground, but there were always a few hardy souls that rode out the floods on the Mississippi. Most of the population of Tomato, Arkansas, moved out so that their children could attend school, because school buses could not get to the area because of flooded roads. In Caruthersville, Missouri, all of Reynolds Park was covered by the Mississippi except for a flag pole.[8]

A very serious problem developed in Cairo, Illinois, two days after Phase I operations were started. Just after noon on March 7, water began to pour out of a manhole on 10th Street near the floodwall. Local officials called Corps personnel and off-duty police and firemen to the scene, where water was pouring into the street at the rate of 6,000 to 8,000 gallons per minute. The flow of water threatened to flood the entire city.[9] Subterranean water pressure caused the street to buckle. Corps personnel and volunteers immediately constructed a miniature ring levee around the manhole to equalize the pressure. A diver was called to the scene and entered the flooded sewer pipe, but the tremendous water pressure prevented him from determining the cause of the problem.

Major Allan Braun, deputy district engineer, was on the scene to lead the fight. Corps personnel guessed that the cause of the flooding was a "flapgate" stuck in the open position in the Ohio River end of the sewer pipe. This would allow water from the Ohio River to flow into the city. Divers were sent into the Ohio River, and the sewer pipe was located about 50 feet below the river's surface. The divers confirmed the Engineers' theory about the stuck "flapgate."

Corps personnel began to search for a solution to the problem. The concrete sewer was about 280 feet long and varied from 48 to 72 inches in diameter, and extended under the floodwall into the Ohio River. Colonel Robert W. Lockridge, Memphis District Engineer, came to the scene. He recalled hearing about some very large rubber air bags that inflated to 72 inches. Several air bags were located in Philadelphia, and the Pentagon Operations Center allowed the use of a C-130 to bring them from Philadelphia.[10]

The divers descended into the river and positioned an air bag inside the sewer with a steel tube. After the air bag was positioned, air and water were pumped into the bag from a barge. The device worked and the flow into the sewer was stopped late in the afternoon of March 10. Fifty-eight cubic yards of grout was placed in the sewer and the next day an additional sixty-eight cubic yards of grout was placed, effectively sealing the sewer.[11] The four-day battle was won, and Mayor Allan Moss of Cairo lavishly praised the Corps for its help.[12]

Emergency work at Cairo, Illinois, 1979.

On March 8, 1979, when the flood fight in Cairo was just beginning, the Memphis District went into Phase II operations. The expansion of the flood-fighting operations was the result of a National Weather Service prediction of a stage of 54 feet at Cairo.[13] Phase II was a part of the emergency operations activities in which the District mobilizes its forces for flood-fighting operations. The area covered by Phase II was the same as earlier announced for Phase I. For 17 days the Memphis District was mobilized to fight the flood.

Along the Mississippi, the waters began to spill into low-lying areas, and the Memphis District estimated that 200,000 acres in northwest Tennessee were under water.[14] Several highways inside the main stem levees were inundated, and the small towns of Ashport and Golddust in west Tennessee were cut off by 4.5 feet of water. Most of the 250 to 300 residents of the two communities evacuated earlier except for a few that remained to protect their property from looters.

During the mobilization operations the Corps was aided by the use of two helicopters borrowed from Fort Campbell, Kentucky. The helicopters were used for daily inspection of the river banks and levees in the Memphis District's 26,000 square miles. Levee slides, wave wash, and seepage caused problems, but there were no serious threats to the main line levees. Falling river stages caused Colonel Lockridge to end the mobilization efforts, but not for long, because a second rise of the river set in.

It was a cruel joke that "Mother Nature" played on the Memphis District on April 1, 1979. Almost 9 inches of rain fell over parts of the Engineer District.[15] In southeast Missouri approximately 150 residents were evacuated from low-lying areas in Portageville, Missouri, and in parts of Kennett, Missouri, water covered cars up to the windows. Flooding was reported in a dozen communities in the Bootheel of Missouri. Many highways, including parts of Interstate 55, were inundated, and

Emergency levee at Fredricktown, Missouri, 1979.

some schools were closed because of flooding along rural roads.[16]

In eastern Arkansas, flash flooding forced more than 100 residents from their homes in West Memphis. Most of the refugees spent the night in a skating rink or with relatives. The Memphis District loaned the city eight heavy-duty pumps to transfer impounded water over the levees. The heavy rains caused the White, Cache, and St. Francis Rivers to go out of their banks. Drainage ditches could not take care of the runoff, and the waters spilled onto many acres of farmland. The flooding in eastern Arkansas caused the Memphis District to enter Phase I activities in the St. Francis Basin.[17]

Many communities in west Tennessee were struck by the flood waters. Residents of a mobile home park in north Memphis became alarmed when they saw cars and butane tanks floating past their doors, and it took almost 4 hours to rescue 82 residents of the park. In south Memphis water covered parts of Interstate I-240; some 50 cars were damaged. Floods hit Huntington and Jackson, Tennessee, but the worst problems occurred in Trenton. Just north of Court Square a small levee crevassed on the Obion-Forked Deer River, and water up to 5 feet deep caused extensive damage. The water inundated a number of businesses and homes, and damages were placed at more than $100,000 in the city. Numerous rural highways were closed due to the high water.[18]

The heavy rains caused the Mississippi to rise again, and resulted in a second flood mobilization for the Memphis District. Phase I operations were already under way in the St. Francis Basin, and Colonel Lockridge announced that Phase I operations were again under way along the Mississippi on April 12, 1979.[19]

A levee along the Cache River constructed of dredged material crevassed causing the river to spill into the small community of Grubbs, Arkansas. The Weather Service warned residents in low-lying areas along the Cache, White, and Black Rivers in Arkansas to remove livestock and valuable property. Governor Teasdale declared 17 counties in eastern Missouri disaster areas.

The National Weather Service predicted a stage of more than 54 feet at Cairo, which caused the Memphis District again to enter Phase II operations on April 14. The area covered by Phase II was the same as that of Phase I. The most serious problem for the Memphis District during Phase II developed at Fredericktown, Missouri, about 100 miles south of St. Louis. Heavy rains threatened a private dam holding back about 80 acres of water, and 250 residents below the dam received warnings that the dam might break at any time. Fear of a dam break caused the state of Missouri to call on Memphis District for assistance on April 14. Using Corps personnel and equipment, workers lowered the water level by enlarging the emergency spillway and deepening the main spillway. The work was completed on April 18, and the dam pronounced safe.[21]

In southeast Missouri another serious problem developed near Caruthersville, where heavy wave wash threatened the Cottonwood Loop Levee. The levee had once been a part of the main stem levee system, but had been replaced by another levee. Local officials tried to halt the wave wash with sandbagging but failed, and on April 18 they asked for Corps of Engineers assistance. After a quick investigation, the Corps determined that it had authority to protect the levee and awarded an emergency work contract. Work began on April 20. At a cost of $16,820, approximately 1,463 tons of riprap were placed on the levee to protect it from wave wash.[22]

Many of the problems associated with the second flood mobilization occurred in eastern Arkansas. Flooding continued on the Black, White, Ouachita, Cache, and St. Francis Rivers. The Cache River again went out of its banks and flooded Grubbs, Arkansas. Estimated damage along the river was $1,000,000.[23] Representative William Alexander toured the area and again voiced his support for the controversial Cache River Project. Senator Dale Bumpers, who had opposed the Cache River Project for years, now indicated he was ready to compromise. Residents along the river desired an accommodation that would reduce future flooding.

Falling river stages north of Memphis prompted the Memphis District to re-enter Phase I on April 24, and a few days later all mobilization operations were ended. The Mississippi River Commission reported that six states bordering the Lower Mississippi experienced flooding. Some 3,750,000 acres were flooded, and losses were more than $57,000,000. The Commission reported that 15,000,000 acres had been protected, and the flood control structures had prevented damages estimated to be $13 billion. A local newspaper questioned the accuracy of the figures, but conceded that figures can never express the "intangible benefits of the peace of mind and the feeling of security," the structures provide.[24]

During the 1979 flood, levees continued to be the main line of defense against floods. Time after time they had demonstrated their ability to hold back flood waters, but they had to be constructed properly. The levees along the Lower Mississippi and its tributaries were known around the world, and request for information about them came from many countries.[25] Levees were being upgraded to meet the project flow line established by the Mississippi River Commission after the floods of 1973 and 1975. The main line system consisted of more than 2,200 miles of levee along the Mississippi, and nearly 1,600 miles along the tributary streams. Each District Engineer was responsible for the levees in his District.

Responsibility for the levees sometimes caused problems for the District Engineer. In much of west Tennessee, residents pointed out that their levees were about a foot lower than those on the Arkansas and Missouri side of the river. Local officials feared that flood waters would be thrown into Tennessee, and officials of Lake County often voiced their concern over the problem. A congressional resolution in 1970 authorized an East Bank Levee Study with the view of alleviating the problem.[27] Public meetings were held in 1976, and a plan of study was prepared. Revisions to the project flow line delayed completion of the study. However, the Corps eventually did recommend a 6.5-mile extension of the levee to give the community of Tiptonville, Tennessee, additional protection. In 1979 Colonel William H. Reno, District Engineer, decided the study should be terminated because the primary benefits would protect an urban area, and he determined that such studies ought to be done under a separate authorization. Colonel Reno requested and received authority for a separate study that is still under way.[28]

Most of the work of the District, as it relates to levees, is rather routine design and execution of contracts. Once levee work is completed it is turned over to local levee districts for maintenance. Nevertheless, the work becomes a little controversial at times. The Cottonwood Point Loop Levee near Caruthersville, Missouri, was the result of the construction of a new front-line levee leaving an area of about 300 acres enclosed by the loop levee. The only drainage for the area was through the old front-line levee, which was almost impossible. During high water on the Mississippi the enclosed area could not drain, and the owner often had trouble draining the impounded water. He complained that it sometimes cost him $8,000 to have the area drained. A complete study by the Memphis District concluded that solution to the problem was not cost effective and recommended a local solution to the problem.[29] Nevertheless, more than 100 years after starting work on the Mississippi, flood control remained an important task of Memphis District.

CHAPTER V

Flood Control in Arkansas

Flood control studies and projects have recently taken a majority of the Memphis District's budgetary allotments. Since the Flood Control Act of 1928, more funds have been budgeted for eastern Arkansas than any other project, or area. The only expenditure that comes close to funds expended in Arkansas is for main stem channel improvements. Most of the rivers of eastern Arkansas eventually drain into the Mississippi in the Memphis District, and many residents of the state welcome flood control projects, but others oppose them.

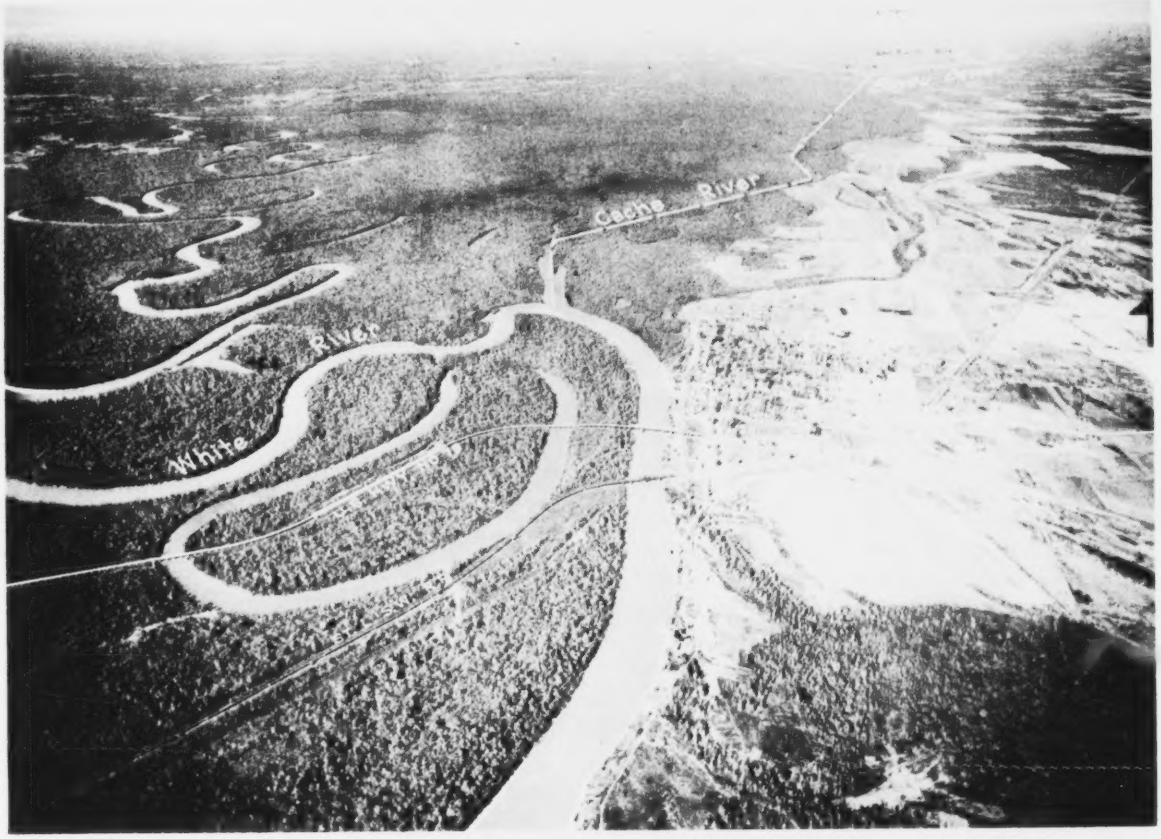
The strongest opposition to flood control projects revolves around the Cache River Basin Project. Congress authorized the project in the Flood Control Act of 1950. The project was designed to improve 140 miles of main channel of the Cache River, 15 miles of upper tributaries, and 77 miles of Bayou DeView. Appropriations for the project were delayed by the Korean War, and after the war Congress ordered a restudy of the project. In 1955 the U.S. Fish and Wildlife Service recommended mitigation of potential damage to wildlife. The Corps' new study, completed in 1959, recommended the project without mitigation. Between fiscal year 1967 and 1971, Congress appropriated more than $7 million for the project's design, engineering, construction, and mitigation.[1]

In the early 1970's the project became embroiled in controversy. Across the nation many Americans had become environmentally conscious. One result had been the National Environmental Policy Act of 1969. The law had a tremendous impact on Corps of Engineers activities. Under terms of the act the Engineers were required to prepare environmental impact statements on almost all of their projects. Corps personnel began preparing such a statement for the Cache River Basin Project, but the additional work delayed the project for many months.

On August 27, 1970, Colonel Charles T. Williams, District Engineer, conducted a meeting at the District headquarters concerning the Cache River Basin Project. Most of the interested parties attended the meeting. Colonel Williams informed the gathering that he intended to award a contract for the first construction in December, and that those supporting the acquisition of mitigation lands would have to wait on specific congressional authority. He also informed the participants that the environmental impact statement was almost completed.[2]

The draft environmental impact statement was filed with the newly established Council on Environmental Quality on December 7, 1970.[3] In the statement the Engineer District recommended the acquisition of 30,000 acres of mitigation lands. Drainage interests supported the plan as long as it did not delay construction. The District Engineer had authority and funding to initiate the project, but delayed because of the proposal for mitigation lands. In October 1971, Colonel John V. Parish, Jr., District Engineer, announced his intentions to award a contract for the first construction, but the contract was delayed by court action.

On October 6, 1971, the Environmental Defense Fund filed suit in Federal Court questioning the adequacy of the environmental impact statement. On May 12, 1972, the District Court ruled the environmental impact statement was adequate and dismissed the complaint, but the plaintiffs filed notice of appeal. In the spring and summer construction was begun near the mouth of the river, but only about 4 miles of channel work were completed in March 1973, when the Eighth Circuit Court of Appeals issued an injunction



Cache River Project.

halting the work and remanded the case to the District Court.[4] Following another hearing in District Court, the environmental impact statement was found to be inadequate and further construction was enjoined.

A revised environmental impact statement was prepared by the Engineer District, and submitted to the Environmental Protection Agency (EPA) in November 1973 for the agency's comments. In January 1974, the EPA notified the District that the agency had strong environmental reservations relating to the effects of the project on water quality, and rated the statement as insufficient due to lack of information with which to determine the long-term effects on water quality.[5]

Two significant events related to the Cache River Project occurred in 1974. The 1974 Water Resource Development Act authorized the purchase of 30,000 acres of woodlands and the preservation of another 40,000 acres by the acquisition of easements that would prevent the land from being cleared. The final environmental impact statement on the Cache River Project was prepared and filed with the Council on Environmental Quality on November 8, 1974. An evidentiary hearing was held in the District Court of Arkansas in November of the following year. On March 29, 1976, the injunction halting further work was lifted and the suit dismissed.[6] In November, 1976, work commenced on another 3 miles of channel work.

After construction of the second item, the Save the Cache Committee and the Arkansas Game and Fish Commission funded a study by Dr. Sherwood M. Gagliano of Coastal Experiments, Inc., located in Baton Rouge, Louisiana. The purpose of the study was to examine alternatives to the Corps sponsored project. The Environmental Defense Fund's request for a delay in bid advertisement for the next contract pending completion of Dr. Gagliano's study was granted on February 18, 1977. On July 25, Colonel Lockridge asked the Arkansas Game and Fish Commission to suggest that Coastal Environments, Inc., present its findings at a meeting in the District Engineer's office on August 11. At the meeting a brief outline of the study was presented by Dr. Gagliano because he had not finished the report.[7]

Several people, including Colonel Lockridge, tried to work out a compromise. Representative Alexander from Arkansas chaired a meeting of many interested people at Greers Ferry, Arkansas, on August 25, 1977, in order to inform all parties of the status of the project and to reconcile differences. The audience applauded the Corps for purchasing the first 120 acres of mitigation lands. After meeting most of the day, all parties agreed that such meetings were desirable and other meetings would be necessary. However, this meeting failed to resolve any of the issues.[8]

Lockridge scheduled another meeting for October 4 and 5 in his Memphis office. Its purpose was to review the authorized plan and to hear Coastal Environments' alternative recommendation. More than 50 people attended the meeting over the two-day period. Lockridge outlined the authorized plan and announced the purchase of 5,449 acres of mitigation lands. Gagliano recommended restoration and continued maintenance of the previously channelized stream accomplished by private interest in the upper basin. He also recommended construction of upstream reservoirs, and acquisition of a 10-year floodplain in the middle and lower basin. Acquiring the floodplain would require purchasing approximately 100,000 to 110,000 acres. The participants could agree only to a recommendation of Dr. Rex Hancock, member of the Citizens Committee to Save the Cache, that a task force be appointed to explore alternative proposals. No one from the Corps was appointed to the task force.[9] Major General Robert C. Marshall, President of the Mississippi River Commission, said the Corps would continue work on the project, but that it would not interfere with work of the task force, because no contracts were scheduled to be awarded before the task force's report was due on February 1, 1978.

Planning for the next item, approximately 15 miles of channel work, proceeded because the Corps had an authorized and funded project. Colonel Lockridge believed that as long as Congress had mandated a project, work must proceed until an alternate plan was adopted. He defended the project against charges that it would result in the loss of valuable floodplain forest. In 1949 the Cache floodplain contained about 310,000 acres of woodlands, but by 1973 clearing had reduced the acreage to 116,000. The reduction had occurred without the project, but with the project future generations would be assured of the preservation of 70,000 acres if the project were completed.[10]

The task force, composed of representatives from the EPA, U.S. Fish and Wildlife Service, Arkansas Game and Fish Commission, Arkansas Department of Pollution Control and Ecology, and a citizen's conservation representative, reported its findings on January 18, 1978. The members had reviewed six alternatives, including the Corps authorized plan, and they recommended "Plan 5." This plan included rechanneling the upper portion of the basin; a leveed floodway along the 10-year floodplain through the middle basin to the northernmost limit of backwater flooding of the White River; acquisition of 110,000 acres of fish and wildlife; and a 100-foot-wide buffer strip of natural vegetation along both sides of the main channel in the upper part of each basin.[11]

Task force "Plan 5" was reviewed by the Memphis District and the conclusions were adverse.

1. The plan would not provide any more flood protection than the Corps plan, but it would cost approximately $195 million and was not economically feasible.

2. The plan would require that about 30,000 acres of farmland be taken out of production.

3. The land acquisition program would affect an estimated 663 private ownerships and would displace an estimated 200.

4. The land acquisition would remove an estimated annual tax revenue of $109,000. The Corps plan would result in the loss of only $33,000.

5. The task force plan had little support from local residents.

6. The task force plan would delay the project 8 to 10 years.

According to Lockridge, it was time to proceed with the authorized project for there had already been some 25 studies that had considered 17 different proposals.[12]

Planning proceeded on the project for the next 15 miles of channel work, and a statement of findings for the next item was sent to the EPA in February 1978. The next month the EPA rejected the findings because construction methods less environmentally damaging were available. Memphis District reviewed the alternates proposed by the EPA and found that the project would cost an additional $3 to $14 million to construct. In view of the high cost, Lockridge did not consider the plans practicable. In referring the matter to the Mississippi River Commission, he concluded that Congress and the Courts had approved the project and the EPA's action was "a blatant attempt to overrule both the Judicial and Congressional branches through administrative action."[13] Planning for the project continued, but little could be done until the EPA issued a permit for the placement of excavated material. In the meantime, interested parties continued working toward a compromise.

Congress was unwilling to provide funding until the Arkansas congressional delegation agreed on a proposal. Senator Bumpers opposed the Corps plan and Representative Alexander supported it. Attempting to reconcile their differences was United States Senator Kaneaster Hodges of Arkansas. Eventually, Senator Hodges brought the two men together, and they agreed on a compromise. Though the compromise was not signed, it provided for an alternate plan that required: (a) half the money appropriated must be used to purchase mitigation lands; (b) an 11-mile channel built away from the riverbed starting at the mouth of the river; (c) establish a "green belt" along a 90-mile-long section to preserve the area; (d) leveed floodways, or a bypass channel, or "mopping" of the existing channel for the middle section of the basin; and (e) in the upper basin 140 miles to be left in its present state.[14]

Almost at once the compromise began to fall apart. The U.S. Interior Department announced its opposition to the compromise worked out in October 1978. Alexander refused to sign the agreement until the Cache River-Bayou DeView Improvement District, the sponsoring agency, supported the compromise plan. In January 1979, the Corps notified the Arkansas congressional delegation that it was terminating all work on the project until a compromise was hammered out. Colonel Lockridge appeared before the Arkansas Game and Fish Commission on April 16, 1979, and told the Commission that all work had been halted because the opponents "seemed more interested in making noise than either flood prevention or preserving the area."[15] Lockridge said the Engineers would do no further work, either in planning, construction, or mitigation. Dr. Hancock of the Citizens Committee to Save the Cache said Lockridge was "paranoid" about the Cache.[16] Through February 1979, the Memphis District spent approximately $8.1 million on the project. Seven miles of channel were completed, two bridges modified, and approximately 8,000 acres of mitigation lands purchased.[17]

During the spring flooding in 1979, the Hodges compromise plan was discussed again, but nothing came of the discussion except more bitterness. Since that time others have made proposals, but they have led to only more controversy. On June 5, 1980, the Cache River-Bayou DeView Improvement District, the sponsoring agency, withdrew its support for the project. Without a sponsoring agency, the future of the project remains unsettled.

Memphis District had numerous small flood control projects at various stages of development in Arkansas. At the request of officials of Jonesboro, Arkansas, the Engineer District developed the Whiteman's Creek Flood Control Project. The Corps presented its reconnaissance report at the initial public meeting held in Jonesboro on October 30, 1980. The report indicated that improvements to Whiteman's Creek and Turtle Creek would cost approximately $12.3 million. The District Engineer established a schedule, and at the end of 1981 the study was still under way.[18]

Flooding in eastern Arkansas in 1979 along the L'Anguille River resulted in a restudy of a project that was first authorized by the Flood Control Act of June 30, 1948. The project provided for improvement of the river from its mouth to mile 97.6 and improvement of 14.4 miles of tributary streams. On August 2, 1971, Colonel John Parish, the District Engineer, declared the project inactive because no local sponsoring agency had come forward to assume local responsibility for the project.[19] Until 1979 little interest in the project was voiced by the residents of the river basin.

After a meeting with flood-plagued citizens of Marianna, Arkansas, in April 1979, Senator Bumpers requested the Corps of Engineers to take another look at the project. Colonel Reno, then District Engineer, informed Senator Bumpers that the best solution to the problems of flooding in the L'Anguille Basin was the formation of a local sponsoring agency for the inactive L'Anguille River Project. By December 1979, landowners in the basin had organized a Circuit-Court-approved L'Anguille Improvement District, and Reno requested the Mississippi River Commission to reclassify the project "active." This permission was granted on January 29, 1980.[20]

Colonel Reno notified the Mississippi River Commission of his study plans for the L'Anguille Basin, and noted that the U.S. Fish and Wildlife Service and the Arkansas Game and Fish Commission had already expressed opposition. Because of the lapse of time, the District Engineer recommended a complete re-evaluation of the project in light of environmental concerns and changes in methodology. During the remainder of the year preplanning for the project continued.

In February 1981, Colonel Reno announced initiation of advanced engineering and design studies for the L'Anguille River Project, and scheduled a public meeting for March 30, 1981, in Wynne, Arkansas.[21] Approximately 100 people attended the meeting. Reno outlined his plan to re-evaluate the water and related land resource needs of the basin to determine the best method of flood control. Advanced engineering and design studies were expected to be completed in about 4 years. Reno expressed his determination to develop an environmentally sensitive solution. Several organizations voiced opposition to the study, including the St. Francis Wildlife Association, whose members had unanimously voted against the project.[22] Nevertheless, a spirit of cooperation characterized the meeting.

The Mississippi River Commission budgeted $150,000 for 1981 to advance the study and the Engineer District began gathering information from other agencies involved in the project. In the summer of 1981 approximately 76,000 acres were flooded by the L'Anguille River, and the Improvement District requested that the Engineers move ahead with the project. Reno informed the Improvement District that $350,000 had been allocated for fiscal year 1982, but the Phase I report was not expected to be completed before October

Flooding in Helena, Arkansas, 1974.

1984. If scheduling was maintained, initial construction could start in 1988.[23]

Flood control planning is a slow process, and sometimes frustrating. In May 1974, severe flooding occurred in West Helena, Arkansas, and on June 11, Mayor J. E. Porty of West Helena, formally requested a study of drainage in the city under Section 205 of the Flood Control Act of 1948. A Reconnaissance Report of June 1975 showed justification for additional studies. Detailed studies began in 1975, but due to lack of funding and manpower, the studies were delayed again and again. The Corps notified several interested agencies that the detailed project report was scheduled for submission to the Mississippi River Commission in June 1981. When officials of West Helena received the news, they hardly knew what to think; they had never heard of such a project. The new mayor of the city, Bob Teeter, had not been told of the project by his predecessor. Local officials indicated that financial constraints prevented them from sponsoring the project. Planning continued, however, while the officials decided what to do. On December 30, 1980, the City Council voted not to support the project, but indicated the possibility of future participation should funds become available. Memphis District terminated the project in March 1981. The project had cost the District $193,000, an expense that was unrecoverable.[24]

Many communities do not understand the problems the Corps of Engineers has in developing a flood control project. Corps guidelines establish a step-by-step procedure. From reconnaissance report to construction is a time-consuming operation. Other agencies, such as the EPA, U.S. Fish and Wildlife Service, State Game and Fish Commissions, and transportation agencies have to be contacted to determine if the project affects their responsibilities. At any time the project may be delayed for months by one or more of the agencies. The delays usually result in a more economically feasible and environmentally sensitive plan, but local officials, who want flood control immediately, often fail to understand the delays.

After experiencing flooding twice in 1974 and again in 1975, officials of West Memphis, Arkansas, sought emergency relief. The Committee on Public Works of the United States Senate adopted a resolution on May 29, 1975, urging the Corps of Engineers to investigate the problems of the city.[25] Colonel Lehman, the District Engineer, requested $300,000 to conduct the studies, and approval was granted. Within a few months he found the project feasible and recommended cleanout of 25 miles of Fifteen Mile and Ten Mile bayous. To speed the planning process, he recommended the work be done as a modification of the St. Francis Basin Project, as that would not require congressional approval. Because a public meeting related to a larger study of flood problems in the West Memphis vicinity had already been held, the public meeting requirement was postponed until the study reached another stage. Everything was moving along rapidly.

By March 1976, notices of study initiation, required by Corps regulations, were mailed to interested officials. The public was invited to send their comments to the District office. The draft plan of study was made public in August. The flood control project was moving with amazing speed, but the mayor of West Memphis complained of unnecessary delays.[26] Colonel Lockridge informed the mayor that the Mississippi River Commission had required him to develop additional data to assure the best possible degree of flood control for the city. Such delays pushed the date for the final public report back to June 1979. At a meeting with city officials in March 1978, the Engineers, despite objections from the mayor, indicated the final report would not be completed before 1981. The mayor again complained of the delays in September 1979, and Lockridge informed her that he had been directed to combine the study with a larger one that had been under way for many more years.[27] The task of gathering data continued, and in August 1981, the Engineers indicated the long-awaited report was proceeding according to schedule.

Across the river from Memphis is the largest basin in the lower Mississippi Valley. St. Francis Basin is located in northwestern Arkansas and southeast Missouri. The area was once called "swamp land," but local interests began systematic drainage projects in the early 1900's. Congress in the 1920's authorized the Engineers to report on further improvements that might be needed, and the Engineers' recommendations were included in the Flood Control Act of June 15, 1936.[28] Major features of the project consisted of more than 400 miles of levees, three pumping stations, eight flood control and diversion structures, and one dam and reservoir. The project was designed to protect more than 1.4 million acres of land, and numerous communities in Arkansas and Missouri. Since the project's inception, the Memphis District has expended more than $200 million on it.[29]

The St. Francis Project experienced many delays in the 1970's, partly the result of increased environmental consciousness. The Corps, including Memphis District, changed its policies and regulations to ensure that environmental quality was given equal consideration with economic development; the District won numerous awards for its environmental designs. At the same time, several projects involving dredging and excavation were under way, or being planned, for the St. Francis Basin. To prevent adverse effects on cultural resources, Colonel Lockridge awarded a contract for an archeological survey of the entire St. Francis Basin on March 21, 1978.[30] Though beneficial, the survey brought a complete halt to one item of construction.

The Buffalo Creek Diversion Project was designed to relieve flooding in Craighead and Mississippi counties in northeastern Arkansas. Significant archeological sites were found in the project right-of-way in the fall of 1979. The District Engineer halted work until the sites could be investigated. The investigation caused a 7-month delay in the project, and also cost the District $150,000 in standby fees to keep contractors' equipment on the job.[31] Construction resumed and plugs were left in the channel so that the archeological investigation could continue. After the investigation is completed the plugs will be removed.

Concern for the environmental impact of the project produced another delay. Flooding in 1973 caused heavy siltation of the St. Francis River near Madison, Arkansas. Difficulties in acquiring the right-of-way delayed the work until September 1977. In September 1978, the Vicksburg Office of the U.S. Fish and Wildlife Service notified the District Engineer that an endangered species, the fat pocketbook pearly mussel (proptera capax), had been found in the St. Francis River. The District Engineer halted work in November 1978 to permit an investigation of the endangered species.[32] The investigation was completed in the fall of 1980, and Memphis District received an opinion from the U.S. Fish and Wildlife Service that continued dredging at the site might destroy the habitat of the mussel. In June 1981, Colonel Reno canceled the project and began evaluating alternatives. The new studies were scheduled to be completed in the summer of 1982.

CHAPTER VI

Flood Control in Missouri, Illinois, and Kentucky

Flood control in the northern section of the Memphis District consisted of block drainage studies, flood control on the tributary streams, and maintenance of the main stem levees. Main stem levees were essentially complete except for upgrading and the construction of berms at various locations. Occasionally a levee slide caused problems, but they were not usually a serious threat.

One of the main areas of concern for the District was the New Madrid Floodway. The floodway was a part of the Jadwin Plan of flood control that was constructed after the flood of 1927. Stretching from Birds Point to New Madrid, Missouri, the floodway was approximately 5 miles wide and could carry 450,000 cubic feet per second. The floodway was designed to relieve flooding at Cairo, Illinois. When the Mississippi River reached a certain stage at Cairo, the levee of the floodway would be crevassed allowing part of the flow into the floodway. Since its completion it has only been used once, and that was during the flood of 1937. Because of its infrequent use, landowners inside the floodway have often advocated its abandonment, or upgrading the main stem levee enough to hold back the Mississippi without its use.

On April 9, 1965, the Senate Committee on Public Works requested a review of the New Madrid Floodway to determine the feasibility of enclosing the floodway and constructing a pumping station to carry off interior drainage in the floodway.[1] Somewhat later the same committee requested the Corps to review the project for the St. Johns Bayou area nearby. The St. Johns Bayou and New Madrid Floodway studies were combined and a review report was submitted in 1974.

The area to be protected extended from near Commerce to New Madrid, Missouri, and included approximately 126,000 acres of farm land and about 1,800 acres of urban areas. The plan called for three pumping stations, one outlet structure, 81 miles of channel improvement, and about 14 miles of new channel.[2] At the urging of the U.S. Fish and Wildlife Service, the Engineers agreed to purchase 2,500 acres to mitigate the loss of fish and wildlife habitat. The Water Resources Development Act of 1976 authorized Phase I planning at an estimated project cost of nearly $23 million.

A Phase I study is a re-evaluation of the water and related land resource needs of the area to determine if the plan recommended in the Review Report is still the best method of providing flood control. During the planning stages the original plan of flood control may be adopted or some modification may be necessary as new information is accumulated. By early 1978, the Memphis District was still in the early planning stages of its Phase I study for the St. Johns-New Madrid area.

Meanwhile, landowners in the floodway complained of perennial flooding and the cost of removing interior drainage. Because the levee at the New Madrid end of the floodway was lower, backwater flooding was a problem in the floodway. Logs and other debris were left in the floodway by the Mississippi River. One farmer complained that he had to use a caterpillar for 7 days to clear 700 acres of debris at a cost of between $25 and $50 per acre.[3] Colonel Reno indicated that he was moving on the project as rapidly as resources permitted.

A public meeting was held in Sikeston, Missouri, on September 4, 1980, to present the Engineers' recommendations as well as several alternate plans. The recommended plan did not differ materially from the original review report except for the inflationary effects. Memphis District estimated the project cost at $83 million.[4] There were a number of opponents to the mitigation plan at the public hearing. Some farmers protested that the mitigation plan would require the purchase of valuable farm lands, and others objected because it would take valuable lands off the tax rolls and reduce income for local governments. Nevertheless, a majority supported the recommended plan. In late 1981, the District Engineer, Colonel John Hatch, submitted a general design memorandum to the Mississippi River Commission, but construction was not expected until late 1984.[5]

Blocked drainage studies are an important part of the Engineers' flood control activities. Under terms of the Flood Control Act of 1946, the Chief of Engineers has discretionary authority to construct drainage facilities to correct deficient drainage problems created by levees construction. When requested, the Corps of Engineers conducts studies to determine if levees cause flooding. The studies take time and money, and often result in findings that the flood problem is not a federal responsibility. One such study concerned flooding of about 1,400 acres below Commerce, Missouri. The District determined that inadequate drainage resulting from clogged channels caused the problem. However, private interests, not Army Engineers, constructed the channels and a culvert to carry away drainage even before the Corps levee was constructed. A report was submitted to the Mississippi River Commission in May 1972, and in November 1977, the Commission determined that it did not have the authority to perform the work.[6]

Occasionally, blocked drainage studies resulted in assistance to flood victims. The Inter-River Drainage District of Missouri requested help to prevent flooding in Butler County, Missouri. Damaging floods often occurred several times during the year due to blocked drainage. The District received authority to conduct a study, and the Engineers found that within the area siltation caused several drainage ditches to clog. A contract was awarded to correct the problem in October 1979, and the work was completed in late 1980.[7]

Water discharged from Lake Wappapello sometimes caused flooding in southeastern Missouri. Located on the St. Francis River near Poplar Bluff, Missouri, the Wappapello Dam was completed in 1941 and was designed to impound runoff from the higher elevations. The channel below the dam was designed to carry releases from the lake up to 3,800 cubic feet per second, but since the dam was completed, releases from the lake often exceed this limit resulting in flooding of cropland adjacent to the channel.

Local residents asked the Corps of Engineers for relief from the flooding. After a study of the problem, Colonel Lockridge recommended the St. Francis River channel be realigned along a 4.5-mile reach below the dam, and snags and debris be removed from another 9 miles of channel. The improvements were designed to allow the release of 7,000 cubic feet per second from Lake Wappapello without causing serious flood problems below the dam. A public meeting was held in Dexter, Missouri, on September 1, 1977, to receive comments on the recommended plan and several alternate plans considered by the District.[8]

There was a great deal of opposition by hunters and fishing enthusiasts to the realignment of the St. Francis channel at the public meeting in Dexter, Missouri. Colonel Lockridge decided that additional studies were needed to determine if clearing and snagging the channel might accomplish the same objective. After the studies were completed, the Corps decided that clearing and snagging would solve the problem and recommended such a project to the Mississippi River Commission in June 1978. Though the Corps believed the project was environmentally sound, the District modified the project because of environmental concerns of local residents.

Wappapello Dam and Lake near Poplar Bluff, Missouri.

Another area in the upper part of the Memphis District that often had serious flood problems was the Mounds and Mound City area in extreme southern Illinois. The area is located in the narrow area near where the Ohio River enters the Mississippi. Between 1892 and 1940, 80 floods occurred in the vicinity of Mounds and Mound City.[9] During high water on the Ohio River, the flood waters often broke across the low area, and after 1938 several flood control structures were constructed to protect the area.

Local officials of the area requested additional help with flood control because continuous flooding prevented growth of the area. The District recommended that a pumping station and several drainage channels be constructed to relieve the problems of flooding. The U.S. Fish and Wildlife Service asked that fish and wildlife habitat in the area be protected, and after a restudy of the recommended plan, Colonel Lockridge recommended that a weir structure be made a part of the overall plan to provide habitat for fish and wildlife. The weir structure would create a pool with a surface area of about 65 acres. Local sponsors agreed to provide public access to the recreational area and to support the modifications of the project in April 1972.[10] The revised general design memorandum was submitted to the Mississippi River Commission, which, in October 1978, forwarded it to the Chief of Engineers for review and approval. The Chief of Engineers approved the plan in March 1979 on the condition that the pumping station be redesigned to reduce the cost of the project. A review of the pumping station was still under way in the spring of 1982.

In western Kentucky the Memphis District has jurisdiction over flood control on a number of small streams that flow into the Mississippi River. The major flood problem relates to backwater flooding by the Mississippi. In early 1975, the mayor of Wickliffe, Kentucky, requested the Memphis District to relieve backwater flooding on Beech Creek near the city. A reconnaissance study was completed in the fall, indicating that a feasible solution to the flood problem was possible.[11] The Mississippi River Commission gave approval for a more detailed study; however, funds were not appropriated until 1977. The Corps proceeded to develop several options, which were ready for review in March 1978. However, the politicians were anxious to get the project under way. In April 1979, United States Senator Wendell H. Ford of Kentucky complained that "It [was] inexcusable to keep such a simple project on the back burner for so long."[12]

Memphis District developed four different plans. They included floodplain evacuation, a levee or floodwall to protect the city, a ring levee, and a floodproofing plan that would require that each structure in the floodplain be raised so that the floor level would be above the project flood. In late 1979, Colonel Reno, District Engineer, rejected the structural measures because they were not economically feasible. At the same time he suggested that the District might be able to participate in plans for floodplain evacuation, and outlined two such plans. The first plan required the acquisition and removal of all structures, moving the residents, and converting the area into a park at a cost of approximately $1.2 million. A second plan contemplated the purchase of all conventional structures within the floodplain and relocation of all occupants. Mobile homes would be allowed in the floodplain, but would be raised to an elevation of 1 foot above the project flood. Estimated cost of the second plan was about $1,000,000. Under either plan, local officials were required to contribute 20 percent of the costs. Mayor T. A. Juett, Jr., notified Colonel Reno that the city could not provide the local cost unless the city could obtain a grant for the city's share. Juett indicated that obtaining a grant was being investigated. In the meantime, Reno initiated a survey questionnaire of the flood zone to aid the District in completing the plans.

The area south of Wickliffe, Kentucky, suffered from backwater flooding from the Mississippi River. The culprit was the 59-mile-long Obion Creek. Flowing northwestward across the western Kentucky, the stream flows into the Mississippi just north of Hickman, Kentucky. Bayou de Chien joins the Mississippi at the same point. Approximately 535 square miles are drained by the two streams. Backwater flooding usually was confined to the lower 19 miles of the stream, and flooding occurred about every third year in a 50-square-mile area.[13]

Local officials often asked for assistance with their flood problem. The Flood Control Act of 1965 authorized flood control for Obion Creek. Memphis District began studies that resulted in a general design memorandum being completed in June 1971. The plan of improvement consisted of enlarging Obion Creek near Pryorsburg, Kentucky, downstream for nearly 32 miles. For the next 4.6 miles a new channel would be excavated, which would empty water into Bayou de Chien. A 1.5-mile section of the bayou would also be enlarged just above where it entered the Mississippi. When completed the project would protect about 30,000 acres from flooding.

The U.S. Fish and Wildlife Service expressed its concerns to the District in January 1971 about the plan's effect on fish and wildlife habitat.[14] Because of Fish and Wildlife Service reservations, the Office, Chief of Engineers, returned the general design memorandum to the District for review with instructions to determine if fish and wildlife mitigation was needed. The Fish and Wildlife Service recommended that nearly 10,000 acres be set aside to mitigate the losses, though they submitted no data to justify the acreage. Because of this additional study requirement, the project was delayed. Colonel Lehman eventually recommended purchase of 6,000 acres to mitigate project losses.

In February 1975, the Corps released a draft environmental impact statement that immediately upset the EPA. A part of the project called for an 8-mile-long continuous levee of excavated material below mile 9 of Obion Creek. The EPA thought the report inadequate because regulations required that the Engineers identify the acreage of wetlands destroyed by dredged material. Other critical comments related to the failure of the Engineers to identify the acreage that might be cleared for cropland because of improved drainage.[15]

The general design memorandum, environmental impact statement, and mitigation report were sent to the Mississippi River Commission in March 1976 and forwarded to the Chief of Engineers in May. Colonel Lockridge sent out a public notice on July 28, 1976, to comply with Sections 313 and 404 of the Federal Water Pollution Control Act. Regulations required a permit to place dredged material in wetlands. The document stated that the Corps intended to place dredged material on a small section of wetlands and that any legitimate agency could request a public hearing on such matters. The Western Kentucky Wetlands Preservation Committee requested a public hearing in the fall of 1976.

The Environmental Defense Fund expressed strong opposition to the project for a number of reasons. First, the placement of dredged material would result in the loss of wetland habitat. Second, less environmentally damaging alternatives were available. Third, it was the responsibility of the Corps to restore and maintain the chemical, physical, and biological integrity of the nation's waters.[16] The organization joined the Western Kentucky Wetlands Preservation Committee in requesting a public hearing and calling for a halt to the project until all concerns could be addressed. In response, the Corps conducted a public hearing in February 1977 at Clinton, Kentucky.

The hearing resulted in the Corps of Engineers agreeing to study the effects of placements of dredged material. A 4-month-long study determined that 5,850 acres of wetlands existed in the Obion Creek Basin, and the project was redesigned to confine the dumping of dredged material to only 185 acres of wetlands. The new study resolved one problem, but other objections delayed the project again.

On May 24, 1977, President Jimmy Carter issued Executive Orders 11988 and 11990. The orders required that federal agencies provide leadership to preserve and enhance the natural and beneficial values served by wetlands and floodplains, and to minimize the destruction, loss, or degradation, of wetlands.[17] The EPA and the U.S. Fish and Wildlife Service believed that the project violated the two Executive Orders, and until the matter could be resolved, the project remained in abeyance.

To try and resolve the difference with the EPA, Colonel Lockridge met with EPA officials on September 29, 1977. The two agencies agreed to re-evaluate the plans concerning placement of dredged material. In October, Lockridge modified the project again to eliminate the placement of dredged materials from all the remaining 119 acres above the Obion Creek mouth at an additional cost of about $250,000.[18] He notified the EPA that he had complied with all regulations in planning the project, but the EPA still objected to the project. Because a stalemate with EPA developed, Lockridge submitted the problem to the Mississippi River Commission for resolution.

The final environmental impact statement was filed with the EPA on January 27, 1978, but construction was further delayed while various agencies reviewed the report. Again, the Fish and Wildlife Service and EPA objected to the project because they claimed it did not comply with the two Executive Orders. Discussions in Washington between the EPA and Lieutenant General John W. Morris, Chief of Engineers, led to a compromise on June 28, 1978. The compromise included:

1. Acquisition of 6,000 acres of mitigation lands to take place concurrently with construction.

2. Elimination of economic benefits associated with clearing of 4,200 acres and preserving the acreage instead.

3. To the maximum extent possible construction would utilize natural channels, oxbows, riffles, and other natural characteristics.[19]

The first part of the agreement required congressional authorization, which delayed the project again.

A supplement to the final environmental impact statement was prepared and submitted to the EPA on October 16, 1978. The purpose of the statement was to address the comments received on the earlier statement, and to deal with the problem of placement of dredged material. In April 1979, EPA reported the supplement inadequate and requested the compromise agreement be made a part of any report submitted to Congress, and Colonel Lockridge complied with the request. Much of the opposition centered on the projected loss of 4,200 acres of wetlands that would be cleared for farmland once the project was completed. In September 1980, Lieutenant General Morris agreed to include the 4,200 acres in the total 6,000 acres of mitigation lands that were to be acquired.[20] The mitigation report continued to be reviewed by the Chief of Engineers, and the project could not be initiated until the mitigation was authorized by Congress. The future of the West Kentucky Tributaries Project remains uncertain.

CHAPTER VII

Flood Control in Tennessee

Many communities are unaware that the District Engineer, with approval from higher authority, can initiate small flood control projects under the continuing authorities program. Authority for small flood control projects is derived from two flood control laws. Section 205 of the Flood Control Act of 1948 provides discretionary authority for the Chief of Engineers to expend up to $2 million for stream improvement if the work is in the interest of flood control. Section 208 of the 1954 Flood Control Act provides authority to the Chief of Engineers for removal of snags, drift, and other debris and for clearing and straightening of channels. Each project is limited to a federal cost of not more than $250,000.[1]

Both flood control laws require that a local government organization must request a study of a local flood problem. Once a request is received, the District Engineer initiates a reconnaissance report to determine if there is an economically feasible solution to the flood problem. Each project must be complete within itself, be economically justified, and the sponsoring organization must be able to provide all right-of-way and maintain the project after completion. If the reconnaissance report determines a solution to the problem is practical, a feasibility study is undertaken if there is a local sponsor. Should the reconnaissance report indicate the project is not economically feasible, no further studies are undertaken. Occasionally the reconnaissance report indicates that other agencies, such as the Soil Conservation Service, already has flood control plans under way, and there is no need for further study by the Engineers.

The city of Huntington, Tennessee, requested assistance to prevent flooding along an unnamed creek that flowed through the city. Everytime there was sustained rainfall the creek went out of its banks and flooded part of the city. A reconnaissance report indicated a solution was possible. A May 1975 public hearing held in the city indicated public support for the project. However, the project was caught in a funding squeeze. Each year the Congress provides funding for such projects, and when the funds are exhausted there can be no further construction. The city of Huntington's project was caught in a backlog because of a lack of funds.[2]

By August 1976, the detailed project report for the city was completed and submitted to the Office, Chief of Engineers, for approval. The District Engineer, Colonel Lockridge, requested that officials of Huntington provide assurances of local cooperation, and the city responded that it could fund its share of the project. In September 1976, the Corps notified city officials that the Chief of Engineers had approved the project. The project called for 1,110 feet of channel enlargement; 1,870 feet of concrete wall channel; and 3,320 feet of grouted riprap channel. Only one firm bid on the project, however, and its bid was more than 28 percent above the Corps of Engineers estimated cost. Government regulations prohibit awarding of contracts which exceed the estimate by more than 25 percent unless it is determined that an error exists in the government estimate. The project was readvertised and, in September 1979, a new bid came within the government estimate. The contract was awarded, and the completed project was turned over to local authorities in a dedication ceremony on October 9, 1981.[3]

At times the Engineer District expends funds in large amounts only to have the local sponsor refuse to fund its share. The Flood Control Act of 1965 authorized a flood control plan for the Mud Lake and Blue Bank Bayou areas near Ridgely, Tennessee. Studies were initiated that determined that channel work and a pumping station would solve the problem of flooding. By May 1976, the Mud Lake Project was in the Phase I Advanced Engineering and Design Program. A request for a study of nearby Blue Bank Bayou resulted in combining the two studies. A new public hearing was held in Tiptonville, Tennessee, on November 30, 1976.[4] The general design memorandum required a revision of the benefit-cost ratio. New studies indicated that the benefit-cost ratio was only marginal and that structural changes were needed in the pumping station to reduce the project cost. However, the design changes did not sacrifice quality. Most of the changes related to the building that was to house the pumps.

Still, the cost of the project caused the local sponsor, Lake County Levee and Drainage District, to have second thoughts about the project. Local costs for lands and damages were estimated at $135,000, and relocations would cost approximately $112,000. The Mud Lake Project required $247,000 in local funding. The cost of running the pumping station would be $37,000 per year. The Levee and Drainage District reported that they were incapable of funding the local share, and asked for a waiver of local responsibility. This the Corps of Engineers had no authority to do.[5] In the spring of 1981, the Levee and Drainage District decided to seek congressional authority to waive the local responsibility except for maintenance cost. At the present time the project is awaiting congressional action.

In addition to the problems encountered by sponsors unable to provide local assurances, the Memphis District became involved in a bitter controversy over the West Tennessee Tributaries Project and the "404" permit program. On the surface neither appears to be related, but they caused several District Engineers enormous problems.

Section 404 of the Federal Water Pollution Control Act Amendments of 1972 assigned to the Corps of Engineers the responsibility of issuing permits to dump dredged or fill material into the waters and wetlands.[6] Anyone planning to conduct activities set out in the law is required to apply for a permit from the District Engineer. If there are no objections, the permit is issued. The Section 404 program contributed to halting one of the larger projects under way by the Memphis Engineer District—the West Tennessee Tributaries Project.

Extensive channelization of the west Tennessee tributaries took place in the 1920's and 1930's. The Flood Control Act of 1948 authorized flood control for the Mississippi tributaries in west Tennessee. Tributary streams of the Mississippi in northwest Tennessee drain approximately 4,500 square miles. The Obion and Forked Deer rivers and their tributaries comprise the basin. Flood control for the two rivers included realignment of about 118 miles of main stem and tributaries on the Obion and about 106 miles of the Forked Deer system. Construction began in 1961 and was progressing until conservationists became alarmed at the loss of wildlife habitat.

On April 23, 1970, four duck hunters, led by Clark Akers, filed suit in the District Court alleging the flood control project was harmful to fish and wildlife resources, and violated the regulations of the National Environmental Protection Act. Several environmental groups subsequently joined the suit. Work continued on the project while the suit was being heard. The project was about 32 percent complete when on March 2, 1973, the District Court ruled that the environmental impact statement was inadequate and prohibited additional construction. The Court directed the Corps of Engineers to submit a revised environmental impact statement.[7]

Work on the West Tennessee Tributaries Project continued, but without Corps of Engineers participation. The Tennessee Legislature had created the Obion-Forked Deer Basin Authority to continue the project that had been halted by the District Court. No environmental impact statement was necessary because no federal funds were involved. Eventually, the authority's charter was expanded to permit a program for the comprehensive development of the water and related resources in a 14-county area of west Tennessee.[8] The Basin Authority began operations in July 1973, and within a year the agency had completed 37 miles of channel work.

Memphis District began working on the revised impact statement, and by the summer of 1975 the document was completed. On September 2, 1975, the government filed a motion to dissolve the injunction. There followed a protracted period of litigation lasting almost 3 years with both sides filing briefs and motions. In the meantime, other parts of the project proceeded.

The injunction did not cover the purchase of mitigation lands. The Water Resources Development Act of 1974 had provided for the acquisition of 32,000 acres of land to mitigate fish and wildlife losses.[9] Initial negotiations for mitigation lands followed procedures established earlier of purchasing only from willing sellers. Many farmers in the area bitterly opposed the mitigation plans for it included many acres of productive farmland. Nevertheless, the District Engineer was in the process of acquiring 125 parcels and in June 1975, Colonel Lehman announced the purchase of the first 40 acres.[10]

The Corps of Engineers began to implement the Section 404 permit program, and in February 1976, the Obion-Forked Deer Basin Authority applied for a permit on its work, but because of the litigation, the Corps of Engineers refused to issue the permit. With limited funds the Basin Authority continued to operate, but it became involved in a heated controversy with the EPA. In August 1977, the EPA ordered the Basin Authority shut down under penalty of $10,000 a day fine and possible jail term.[11] Over the next several months the threat of a shutdown was removed after several conferences in Nashville and Washington. Near the end of 1978 the Basin Authority requested "404" permits in areas that required dredged material to be placed in wetlands, and the permits became involved in the original lawsuit that had halted the Corps sponsored project.

On January 27, 1978, the District Court issued its ruling on the revised environmental

Flooded areas in the West Tennessee Tributaries Project, 1975.

impact statement, declaring it did not meet National EPA standards. The government filed notice of appeal, but it was later withdrawn. The injunction issued in 1973 prohibiting further work remained in force. Four additional motions were filed by the plaintiffs. The plaintiffs asked the Court to prohibit issuance of Section 404 permits in the project area. In February 1978, Colonel Lockridge held a public hearing on Obion-Forked Deer Basin Authority's request for seven permits, and at the hearing several environmental groups and agencies opposed the issue of the permits.

On September 29, 1978, the National Ecological Foundation filed suit in District Court in Nashville, Tennessee, contending that the Corps administration of the permit program for the West Tennessee Tributaries Project had not been proper. A change of venue was granted, and the case was transferred to the District Court at Memphis. No injunction halting the permit program was issued, and the processing of permits continued.[12]

The District Court's ruling the previous January had directed the Engineers to revise the environmental impact statement to determine the cumulative effect of Corps projects in the entire Memphis District, and not just the West Tennessee Tributaries Project. While Colonel Lockridge was preparing the revised impact statement, efforts were under way to get the parties together for discussions and a possible compromise. After several meetings between the disputing parties failed to resolve the issues, Tennessee Governor Lamar Alexander appointed a task force in the spring of 1981 to find an acceptable solution and get the project going again. The task force asked Memphis District to find innovative ways to carry on the project and still assuage the concerns of the opposition. It recommended that any new flood control plan respond to four major concerns: (a) economic feasibility; (b) restoration of floodplain integrity; (c) reduction of soil erosion; and (d) improvement of water quality.[13]

After extensive investigation, the new District Engineer, Colonel Reno, recommended a plan that would achieve the task force's goals. It included: (a) channel enlargement from one side only; (b) construction of drop structures or riprapped outfalls at locations where side drains enter at higher elevations; (c) lateral drainage ditches to permit drainage of low areas; (d) reestablishment of abandoned bendways; and (e) easements that would prevent clearing and conversion of woodlands.[14] The Corps chose a 12-mile reach of the west Tennessee tributaries for special study to address the four issues. The solution was praised by Governor Alexander. In the meantime, negotiations were started with the view of reaching a compromise that would result in the suit being dropped. Colonel Reno participated in the discussions, and in March 1982, the disputing parties were close to an agreement.

Flood control in west Tennessee included the area surrounding the District headquarters. Memphis is located high on bluffs and there is no serious threat from the Mississippi except for backwater flooding on various tributary streams. Those streams are the Wolf River, Loosahatchie River, and Nonconnah Creek. The last of the three streams has played a large role in the development of the Memphis Engineer District, for the District has worked for many years to develop a flood control plan acceptable to the residents of Memphis and the surrounding area.

Backwater flooding often caused Nonconnah Creek to spill out of its banks, or a heavy storm would make the laconic stream a raging river. After the disastrous floods of 1912 and 1913, the city constructed small levees along the banks, but they proved to be inadequate. A Corps of Engineers plan for the stream was included in the River and Harbor Act of 1937 that resulted in the construction of approximately 22,000 feet of levee extending from the mouth of the stream.

The Senate Committee on Public Works in 1970 and 1972 requested the Corps of Engineers to investigate flood control for Nonconnah Creek.[15] A local sponsor for the project, Chickasaw Basin Authority, was created by the state legislature in May 1971.

In initial meetings with local sponsors, the District Engineer, Colonel Parish, indicated that a plan with channel cleanout and a reservoir appeared to be the best solution to flood problems related to Nonconnah Creek. The Chickasaw Basin Authority began to acquire lands in the area of the proposed lake, but it ran into trouble. A condemnation suit against property owners in the area resulted in the Circuit Court declaring the Basin Authority unconstitutional on grounds that the tax levied by the Basin Authority did not apply to the entire county. The objection was later removed by the Tennessee state legislature.[16]

Though approved by the Chickasaw Basin Authority in 1972, the Engineers' plan quickly ran into opposition. The project features included construction of a 3,280-acre reservoir in the upper reaches of Nonconnah Creek, 7 miles of channel cleanout, 12 miles of channel enlargement, and the establishment of a 600-foot-wide greenway extending 20 miles from the mouth. The opposition, calling itself the Nonconnah Improvement Association, immediately focused on the reservoir feature of the project. Opponents termed the lake a mudhole and a nuisance.[17] The Basin Authority began to feel pressure from the opponents, and though still supporting the recommended plan, they asked the District Engineer to study channelization as an alternative. Colonel Lehman replied that channelization alone could not be economically justified.

In spite of the opposition to the lake plan, Lehman forwarded the report to the Mississippi River Commission in the fall of 1973 for approval. In January 1974, the plan was sent to the Chief of Engineers for his review. During that review, Lehman was asked to restudy the plan and give additional consideration to the reservoir and recreational features of the plan. The Office, Chief of Engineers, had a number of concerns related to potential water quality problems, shallowness of the lake, mosquito control, and pollution problems. If the problems were considered, the benefits assigned to the lake might be less than estimated. Also, Governor Winfield Dunn recommended that the project be implemented for flood control, but the reservoir and recreational features be delayed to give the state time to determine its share of the funding.

In the meantime, the Chickasaw Basin Authority became involved in another lawsuit that attacked its land acquisition policies. Opponents of the project filed suit in Chancery Court in Memphis claiming the Basin Authority was acting unconstitutionally by acquiring lands when there was no authorized plan.[19] In July 1975, the Chancery Court declared the Chickasaw Basin Authority unconstitutional and enjoined it from further land purchases; eventually the ruling was overturned.

The review of the recommended plan by the Chief of Engineers, Lieutenant General W. C. Gribble, Jr., took considerable time, but in June 1976, he approved it. In forwarding the plan to the Secretary of the Army Martin R. Hoffman, Gribble indicated that during Phase I studies the District Engineer would make another study of the reservoir feature to determine if it were still feasible. The 1976 Water Resources Development Act authorized Phase I studies for the Nonconnah Project, which would determine if the recommended plan was the best method of flood control or if some modifications were needed.[20] No funds were appropriated for the study, and the first funds did not become available until late 1977. On December 28, 1977, Colonel Lockridge sent out notices of the initiation of Phase I studies. Lockridge estimated that it would take 2 years to complete the study.

While the study was progressing, the Chickasaw Basin Authority recommended that the reservoir be eliminated in favor of other methods of flood control. The Phase I study was delayed, and by May 1980, it was only 60 percent complete. Colonel Reno indicated that he was considering three alternatives, including reservoir only, channel improvements, and a combination of reservoir and channel work.

At a May 14, 1981, public meeting serious opposition to the District's plan developed. Another public hearing was held on August 21 to review comments received earlier. After reviewing the comments, Colonel John F. Hatch, Jr., District Engineer, abandoned the reservoir plan in favor of channelization. He recommended enlargement of the channel from the mouth of the creek to St. John's Creek, a distance of about 12 miles, and clearing debris from another 6 miles of the channel. Recreational features included 15 miles of bike trail, a 47-acre natural area, and about 4 miles of nature trail.[21] In February 1982, the Mississippi River Commission approved the project, and forwarded it to the Chief of Engineers for review. After approval by the Chief of Engineers and authorization by Congress, the project is expected to take 5 years to construct.

CHAPTER VIII

Navigation

Navigation of the Mississippi River has moved from the Indian dugout to the *Miss Kae-D* pushing probably the largest tow ever seen on the river. The tow's configuration was nine barges across and eight deep, a total of 72 barges. Surface area of the tow was 12.7 acres. Total capacity of the 72 barges was 113,400 net tons. To carry the same cargo, it would take 1,152 boxcars stretching to a length of more than 13 miles or 4,320 tractor-trailers.[1] It was the mission of the Corps of Engineers to keep navigation open for both large and small vessels. By Congressional mandate, the Corps is charged with keeping a 9- by 300-foot channel open at all times.

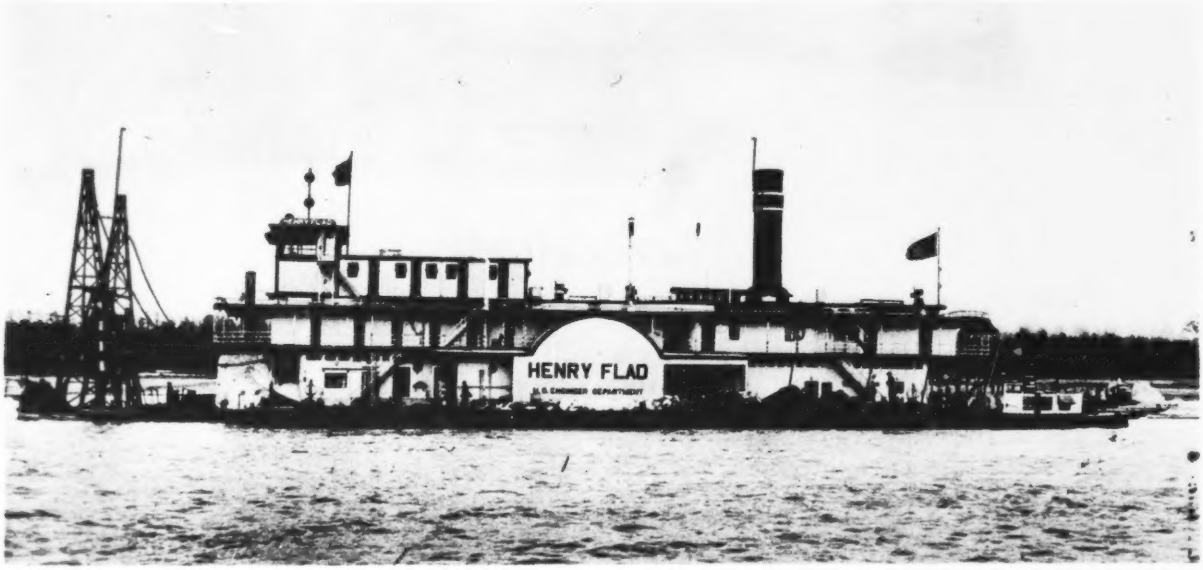
Keeping a navigable channel is important for economic reasons, because approximately 413,000,000 tons of cargo pass through the lower Mississippi each year. The Corps of Engineers uses several methods to keep the channel open, but the most important ones are dredging, revetment, and dikes. All are expensive operations, and consume a large share of the Engineer District's budget each year.

Dredging consists of two types of operations. Maintenance dredging is used to keep the channel open in troublesome locations, where shifting currents drop sediment into navigation channels. It is an annual exercise for the Corps of Engineers. Improvement dredging is used to realign a reach of the river into a desired location and keep it there. Both operations are very costly. Operating expenses of a dredge average about $20,000 per day. The typical work force during the dredging season is a 58-man crew for each dredge. A dredge is operated 24 hours a day with crew members working two 6-hour shifts per day. A dredge uses about 150 barrels of crude oil a day for fuel, each barrel containing about 42 gallons.[2] Towboat operators know the importance of a navigable channel, for they can lose up to $2,500 an hour when grounded or the river is closed to traffic.

Though ice gorges can close the river in the upper reaches of the Memphis District in winter months, low river stages create the most problems. The Corps of Engineers has its own facilities to determine the condition of the river, but during the low-water season employees of the Engineers keep in constant touch with towboat operators and the Coast Guard to determine the condition of the river. The Mississippi is a river of many extremes. Its low-water season varies. On September 21, 1976, the Mississippi set a record low stage of minus 5.7 feet at Memphis. The previous low stage was minus 5.35 feet set on January 24, 1956.[3] In early 1977 the river was closed several times by an ice gorge north of Cairo, Illinois. A few weeks later the river stage at Memphis was minus 4.8 feet, and the Memphis District had to conduct unusual winter dredging. On February 6, 1977, the river set another low-water mark of minus 6.0 feet, breaking the previous mark of the year before.

Record-setting low stages present serious problems for the Corps of Engineers. Low stages in the winter months make it easier for ice gorges to form. In February 1977, the ice gorge near Cairo, Illinois, was 25 inches thick, and the ice had more than 300 barges locked in its grasp. One fear was that the ice gorge might suddenly break, sending ice blocks the size of houses down the river. On a normal day about 24 tows pass the District headquarters near the river, but because of ice gorges in 1977, only about 5 tows were passing Memphis daily.[4] The severity of the low water in 1977 was reflected in expenditures for channel maintenance. During the dredging season, more than $14.2 million was spent to move 23,837,000 cubic yards of sediment.[5]

In 1981 the Mississippi River again set record low-water marks for Memphis District.



Dredge Henry Flad, one of nine dredges in operation around 1901.

On the last day of 1980 the river near Caruthersville, Missouri, was closed by a shallow channel, but about the time a dredge was able to get the river open, the Coast Guard closed the river a few miles downstream at Blytheville, Arkansas. During the last week of December, 27 towboats ran aground, and 67 were waiting for the Engineers to clear the river at Blytheville.

In early January 1981, the minus 6.0 feet record set in February 1977 was broken, and on January 12, 1981, the river at Memphis was closed because of shallow water near the Hernando DeSoto Bridge. The towboat *Ben McCool* was grounded under the bridge several hours before it broke itself loose. Just after the boat had worked itself free, the *Argonaut* went aground near the same location.[6] The Coast Guard asked towboat operators to limit their tows to no more than 25 barges and an 8.5-foot draft. Memphis District had four dredges working at various locations, placing a tremendous strain on the budget.

Because of low water, the river near Blytheville was closed for a second time, and 22 tows pushing 180 barges were tied up waiting for the river to open. Between December 24, 1980, and the end of January 1981, 242 towboats and 2,000 barges went aground. At Memphis, the Mississippi set a record of minus 7.6 feet. The Corps of Engineers had to ask the Office of Management and Budget for additional funds for dredging. Low river stages in 1981 cost the River Commission about $5 million in extra funds.[7]

Improvement dredging is designed to align the channel for better navigation and is often done in the river bends. The Corps of Engineers monitors the river and decides which meander needs improvement. One of the most hazardous parts of the Mississippi River channel was Kentucky Point near New Madrid, Missouri. The channel crossed from the right bank to the left, and then sharply back to the right bank. After a channel improvement planning trip, the Engineers selected the reach for improvement. The first dredge cut consisted of a 300-foot bottom width approximately 9,000 feet long. The dredging took about 72 days, and the cut contained approximately 2,900,000 cubic yards of sediment. Towboats used the first cut while a second cut was made. The second cut was approximately 200 feet wide and contained about 1,300,000 cubic yards, and was completed in about 32 days. Once the dredging was completed, a dike was constructed to help stabilize the reach. Improvement dredging at Kentucky Point cost about $1,600,000.[8]

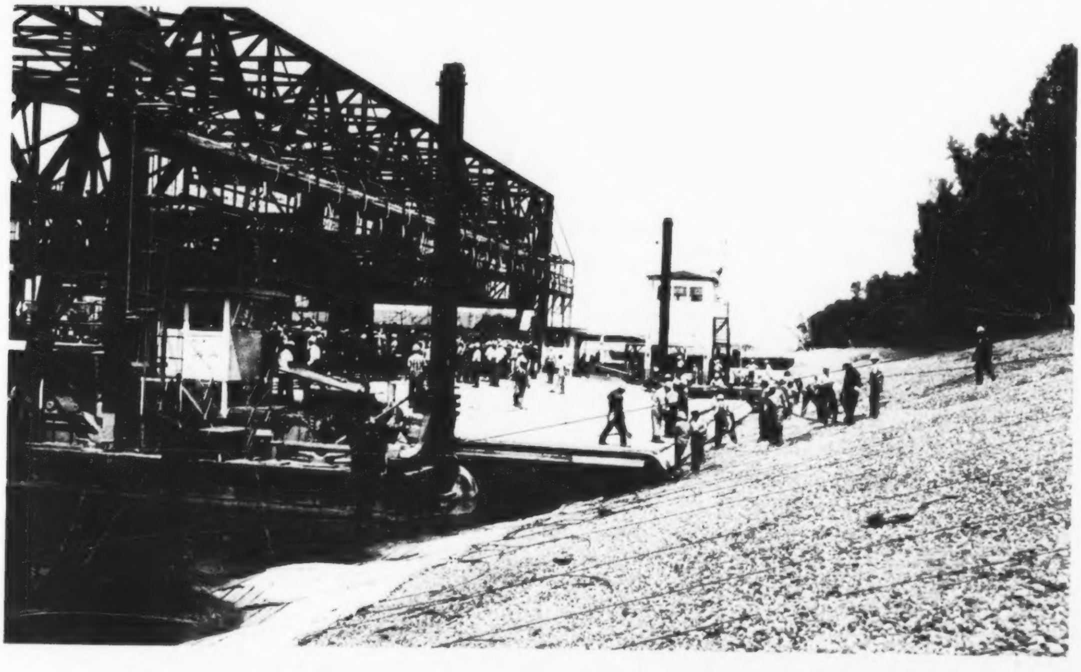
A great deal of the sediment dredged from the channel is a result of bank caving; therefore, bank stabilization is a very important part of maintaining a navigable channel. The nature of the Mississippi River is to meander.

and its appetite for the adjacent banks is never satisfied. Memphis District keeps the river on a diet by covering the banks with articulated concrete revetment. Sites for revetment are determined during inspection trips by Corps personnel, but most of the revetment is placed in the bends of the river where the current does the most damage.

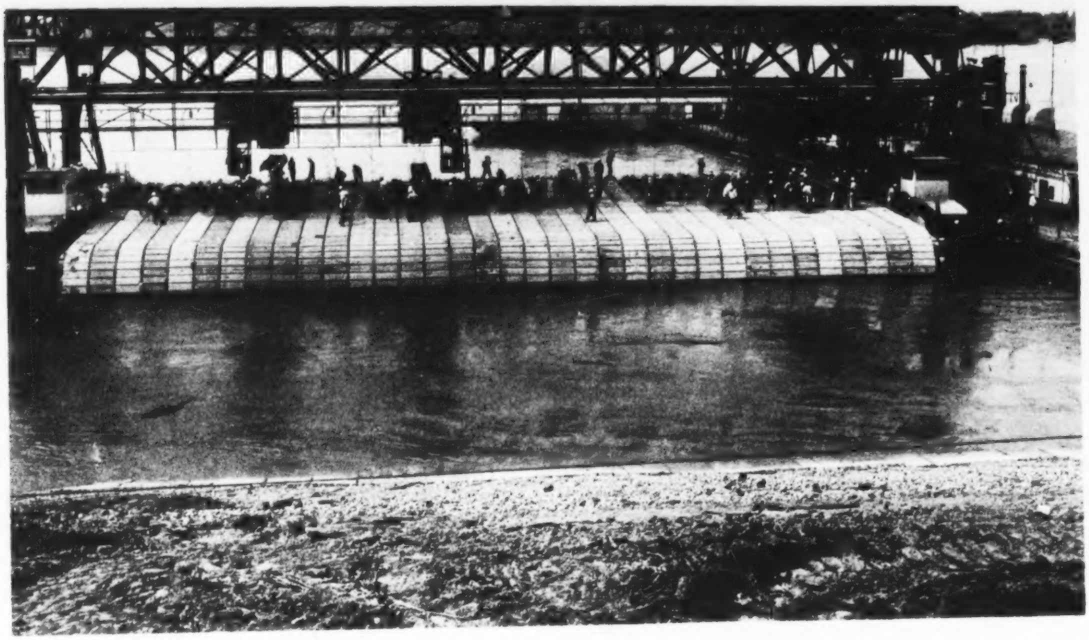
A bank protection unit usually works about 5 months during the low-water season, but budget constraints can shorten the period of work. The bank protection unit is self-contained, with its own power and water supply. Most of the approximately 300 workers of a bank protection unit are seasonal employees and go to other jobs when the revetment season is ended. Many times the unit has more than 100 pieces of equipment, including the quarter boats that provide housing for the workers that remain at the work site.

Employees of the unit work 10-hour shifts 6 days a week. Using mostly power-driven equipment, the workers assemble squares of concrete into mats that reach 140 feet wide, depending on requirements. After the river bank has been graded by heavy equipment, the mat is anchored to the bank of the river. As the mat is assembled, the unit backs into channel allowing the mat to be placed on the bank. On an average day, a bank protection unit can lay approximately 3,000 of the smaller squares. The cost of placing a small square is about $120. Thus, the daily cost of the unit is about $360,000.[9] The bank above the revetment is protected with riprap, and after a section of the bank is protected, the entire unit is moved by towboat to another location.

The concrete squares used by the bank protection unit are cast at five casting fields, two in the Memphis District, two in the



A Corps mat sinking unit at work laying articulated concrete mattresses.



Newly formed rows of the concrete mattresses slide off the sloping deck onto the bank.

Vicksburg District, and one large one in the New Orleans District. Each year the Corps of Engineers looks at its budget and the mattress stock available and decides on the locations for revetment. After looking at the entire length of the Mississippi, the decision is made as to the quantities to be cast at each field. If more mattresses are cast in one field than another, local officials may complain of the economic effects. In determining the quantity produced at each field, the Corps must consider operational, logistical, and economic factors.[10]

The Mississippi River Commission has two bank protection operations: one in the Memphis District and one in the Vicksburg District. Because each wants as much work as possible, work for each unit sometimes causes conflict between the Districts. Colonel Lockridge protested the division of work in 1977, because the Vicksburg District was assigned 62 percent of the work, and Memphis only 38 percent. Also, the District Engineer indicated his unhappiness that Vicksburg was to work a dual shift, and Memphis only a single shift. According to Lockridge, the Mississippi River Commission should determine the work required, where the work was to be done, when it was to start, and when it was to be finished. Then, the total work should be divided equally between the two Districts.[11] He protested the degree of control by the Commission, but indicated he would abide by the decision of the Division Engineer. Apparently the protest was only partially successful because in 1979 the division of work was 58.2 percent for Vicksburg and 41.8 percent for Memphis.[12]

The District Engineer also receives requests from residents along the river to revet their private riverfront to protect against caving banks. The Mississippi River eats away acres of unprotected land each year. Annually, property owners near the river see their property threatened during high water. A large paper mill near Wickliffe, Kentucky, requested help for caving banks in front of their mill. The company constructed a large lagoon to receive the waste from the mill and the caving bank threatened to destroy the dike that confined the lagoon. In requesting help from Memphis District, the company failed to realize that the Corps of Engineers can only spend federal funds for revetment on congressionally authorized navigation and flood control improvements.[13]

Local officials at times call on the Engineers to provide or improve navigation on the larger tributaries of the Mississippi. The most important navigable tributary in the Memphis District is White River. The River and Harbor Act of 1892 provided for an open channel between the White River mouth and Batesville, Arkansas. The act did not specify any channel dimensions, but over the years by dredging, snagging, and contraction works, a channel 4.5 feet deep and 100 feet wide was maintained until 1942. Because of a lack of traffic, the dredging operation was discontinued, and in 1951 all channel maintenance was abandoned. The Office, Chief of Engineers, approved snagging and dredging below Augusta, Arkansas, in 1961 because the River and Harbor Act of 1960 authorized a channel depth of 5 feet and a width of 125 feet.[15] Some years later a 4.5-foot by 100-foot channel was approved for the river between Augusta and Newport, Arkansas.

Because of the small channel dimensions, barge tows were limited to two barges most of the time, and were often loaded to less than capacity. In May 1967, the Senate Committee on Public Works adopted a resolution authorizing the Memphis District to conduct a study of the White River to provide improved navigation. The study was begun in 1969, but because of insufficient funding significant progress was not made until 1975.

In December 1975, at a public meeting held at Newport, Arkansas, the railroads and the Arkansas Wildlife Federation voiced strong opposition to the improvement of the White.[16] The railroads opposed the project because improved navigation of the White would bring serious competition for commerce in the area. The Arkansas Wildlife Federation opposed the project because of the potential loss of wildlife habitat. However, improved navigation would benefit agriculture interests most of all. By early 1978 the study was nearing completion and the opposition was growing stronger. Colonel Lockridge had under study four alternate plans for improving navigation on the White.

When the plan favored by the Engineers became public, the opposition intensified. The plan included deepening and expanding the channel from near its mouth to Newport, Arkansas, a distance of about 244 miles. Within the 244-mile reach, dredging would be required at 154 locations in a 56-mile stretch. Once the project was completed, the channel width would be 200 feet and its depth, 9 feet. To stabilize the dredged channel required the construction of 31 stone dikes and revetment at 13 locations. Recreational facilities were provided at two scenic overhangs, and a 25-acre camping facility. The Corps agreed to purchase up to 1,865 acres to be turned over to the U.S. Fish and Wildlife Service and the Arkansas State Game and Fish Commission to mitigate fish and wildlife losses. Total cost of the plan was $17.2 million.

On April 19, 1979, a public meeting was held in Augusta, Arkansas, to consider the Corps' recommended plan. Even before the public meeting opponents expressed their displeasure, objecting that a planned overhang in the Crocketts Bluff area would destroy hunting and fishing in the area. They requested the overhang be moved elsewhere.[17] Colonel Lockridge informed the group that their request would be considered in the final phase of planning. The opposition was vocal at the public meeting, and after it was over the president of the Grand Prairie Chapter of the Arkansas Wildlife Federation complained that Colonel Lockridge had closed the meeting before they had time to express their opposition.

During the controversy Lockridge retired, but while still in command of the District, he resisted all attempts by opponents of the plan to have a second public meeting because he believed that supporters and opponents had had ample opportunity to express themselves at the first meeting. However, Senator Bumpers joined with many residents of the lower White River Basin in demanding a second public hearing. Colonel Reno, Lockridge's successor, sent Senator Bumpers' request to the Board of Engineers for Rivers and Harbors which was reviewing the plan. The Board recommended an additional public meeting, and Reno conducted one in DeWitt, Arkansas, on May 29, 1980.[18]

The opposition to the plan dominated the second public hearing because it was conducted in the center of the area of most opposition. Some residents objected because of the mitigation features and the placing of part of the dredged material in a wildlife refuge area. Dr. Hancock, leader of the opposition to the Cache River Project, questioned the benefit-cost ratio. Others opposed the plan because it would keep navigation open 95 percent of the year, while under the previous project navigation was open 75 percent of the year. Keeping the White River open 20 percent more each year was not justified by the cost. Colonel Reno indicated that he intended to recommend the project and the meeting ended with supporters and opponents still divided.[19]

On April 8, 1981, the United States Department of the Interior, following a recommendation by its Fish and Wildlife Service, voiced its opposition to the plan and refused permission to place dredged material in the wildlife refuge. Opponents began to lobby Governor Frank White of Arkansas to kill the project, because without a local sponsor to provide the local costs there could be no project. On April 8, 1981, the governor announced his opposition to the Corps plan based on the state's inability to furnish the local cost of $5,760,000. He also questioned the mitigation plans and the benefit-cost ratio.[20] The Arkansas Game and Fish Commission voted unanimously on April 20 to oppose the White River Project. Because of Governor White's opposition, the Chief of Engineers decided to reconsider his previous approval of the plan.

It appeared that the governor's opposition would kill the project, but Governor White indicated that his earlier position on the project had been misunderstood. In July 1981, the governor reported he could not commit the state to its share of the project, but that his position was not to be taken as final and complete rejection of the project. Governor White asked the Chief of Engineers to keep the project in the "active" status, and to continue project planning. When the state's finances permitted, the governor intended to give further consideration to the White River Project.[21] Memphis District continued its planning for the White River Project.

Section 107 of the River and Harbor Act of 1960, as amended, provided authority for the Chief of Engineers to develop and construct small navigation projects that had not already been specifically authorized by Congress. Total federal participation was limited to $1,000,000. Before any construction can take place, the project must be found to be feasible from an engineering standpoint, and expected economic benefits must exceed the estimated annual costs. Studies are undertaken after the District Engineer receives a formal request from a potential sponsor that is capable and willing to provide local financial requirements.

Using the authority provided by the 1960 act, Memphis District has constructed harbors at Helena, Arkansas; Hickman, Kentucky; New Madrid, Missouri; and Osceola, Arkansas. Occasionally studies indicated a harbor facility was feasible, but nothing resulted from the study. In April 1974, local officials of Wickliffe, Kentucky, requested the District Engineer to investigate the possibility of constructing harbor facilities near the city. A reconnaissance report, completed in May 1975, indicated that more detailed studies were justified. The detailed studies were initiated in June 1975 and completed in early 1981. Unfortunately, on March 11, 1981, Wickliffe officials informed the District Engineer that the city could not participate in the harbor project because of financial difficulties. On March 31, 1981, Colonel Reno recommended the studies for Wickliffe harbor be terminated. The District had expended $78,400 for the studies.[22]

A meeting with local officials of Caruthersville, Missouri, in 1972 regarding a local land fill resulted in the city obtaining harbor facilities. The Memphis District conducted a study for a small boat harbor in 1970 and 1971, but terminated the study because of the inability of local sponsors to meet the cost-sharing responsibility. During a meeting related to the land fill, Judge D. J. Meredith of the Pemiscot County Court asked about the procedure to follow in obtaining approval for a harbor project. He was told that local interests were required to gather economic data detailing firms that might use the facility. If the data indicated sufficient use, a study could be initiated.[23] Nothing resulted from the initial contacts, but on January 27, 1974, Judge Meredith formally requested a harbor feasibility report, and indicated the County Court would be the local sponsor.

In May 1974 the studies were initiated, and in March 1975 the reconnaissance report indicated that detailed investigations were warranted.[24] Local officials received permission from the Missouri Department of Transportation to organize the Pemiscot County Port Authority to assume the local sponsor's role. During the detailed investigations, Colonel Lehman, then District Engineer, exhausted the funds for the Section 107 program, and postponed the project. Lehman told the Port Authority in early 1976 that next year's federal budget had no funds and existing funds would be used on studies that were nearly complete. Since Caruthersville's harbor study was in the early stages, the study was suspended until additional funds became available.

When more funds were available, the study was renewed. Lehman's successor, Colonel Lockridge, planned to submit his report to the Mississippi River Commission in late 1977, but delayed the report again. The U.S. Fish and Wildlife Service expressed some opposition to the harbor location because it might damage fish and wildlife habitat. The harbor might also destroy recreational facilities already at the location. At the direction of the Lower Mississippi Division Engineer, Memphis District began to study alternate sites for the harbor, but could not identify a suitable alternative.[25] The detailed report was forwarded to the Division Engineer in August 1978.

A public meeting was held on January 30, 1979, at Caruthersville to present the results of the study. The plan recommended dredging a navigation channel 150 feet wide and 9 feet deep from the Mississippi River channel along the Triangle Boat Club Chute for a distance of 4,680 feet. Dredged material would be placed on an existing landfill that could be used to construct flood-free harbor facilities. The EPA questioned whether dredging the chute might affect the water quality, but tests by the District indicated no potential damage. The EPA questioned the accuracy of the tests and refused to approve the project unless new tests were made to determine if toxic materials were present.[26] Colonel Lockridge ordered additional tests in September 1979 that satisfied the EPA.

Governor Joseph P. Teasdale of Missouri asked for another delay because some state agencies believed that the dredging might violate the Endangered Species Act and various Executive Orders related to the floodplains. Additional studies indicated no endangered species was present nor was there any threat to the floodplain. The studies consumed approximately 90 days, and on July 10, 1980, Colonel Reno approved the report and forwarded it to the Chief of Engineers. The Chief of Engineers approved the report on November 4, 1980. Construction of the harbor was completed on December 30, 1980, at a total cost of about $800,000.[27]

As briefly outlined earlier in this work, Memphis District spent considerable effort to keep the Memphis waterfront from falling into the river and to provide harbor facilities. The Flood Control Act of 1946 provided for harbor facilities on Presidents Island, and construction was completed in 1966 at a cost of $18.7 million. While the harbor project was nearing completion, the Senate Public Works Committee, on April 30, 1965, adopted a resolution requesting Memphis District to study the need for additional facilities.[28]

A public meeting was held on February 24, 1966, to inform the people that the study was under way. The options selected for examination were:

1. Expanding existing facilities on Presidents Island.

2. Developing the chute west of Island 40 just north of the city that was abandoned by the Mississippi River in 1913.

3. Constructing a harbor near the mouth of the Loosahatchie River.

Extended studies were conducted in subsequent years, and in October 1974, a second public hearing was held to present four different locations for harbor facilities. Plan I, Site I, consisted of expanding the facilities on Presidents Island by dredging an additional channel and using the dredged material to create 2,000 flood-free acres for industrial development. Its cost would be approximately $134,000,000. Plan II, Site I, consisted of constructing several channels in the Frank C. Pidgeon Industrial Development south of the city to provide water access to 2,000 acres of undeveloped land at a cost of $103,000,000. Plan II, Site II, involved developing the chute west of Island 40 just north of the city with placement of dredged material to create 2,000 acres of land at a cost of $124,000,000. Plan II, Site III, would be a lock and dam in the upper part of the Loosahatchie River to create a harbor below. The cost would be $333,000,000.[29]

City officials could not make a decision on which plan to support. Colonel Lehman needed local assurances that the city could assume its share of the costs. However, city leaders were apprehensive. Because of concerns about estimated costs, Lehman began studying alternatives. The studies centered on expanding the facilities at Presidents Island and the Pidgeon Industrial Area. The analyses indicated that a project to provide 1,000 acres of waterfront industrial lands on Presidents Island was possible at an estimated cost of $55,187,000. Such a project would meet the future needs of the city for about 30 years. The cost of a 1,000-acre development in the Pidgeon Industrial Area was estimated at $60,689,400. Colonel Lehman informed Mayor Wyeth Chandler that respondents to a survey supported the project for Presidents Island, but that both plans were economically feasible.[30] The Memphis and Shelby County Port Commission supported the expansion of port facilities on Presidents Island.

The study was delayed because the Mississippi River Commission and the Office, Chief of Engineers, questioned the transportation benefits and land needs detailed in the report. These questions were resolved in further studies, and the draft report was sent to the Mississippi River Commission. A third public meeting was held on December 15, 1976, to present the recommended plan: construction of a new harbor channel 4.9 miles long, and using dredged fill material to create 1,000 flood-free acres for industrial development. In November 1977, the Mississippi River Commission endorsed the findings and forwarded the report to the Chief of Engineers, Lieutenant General Morris. The Chief did not question the need for additional facilities, but he did question the rationale for selecting the Presidents Island location. Before sending the report to the Secretary of the Army, he wanted the questions answered.

Reservations about the study by Morris delayed the study many months. The District Engineer submitted data supporting his selection, but Morris questioned the documentation. Local officials became concerned about the repeated delays because the Mississippi River Commission and Chief of Engineers were still questioning the location of the harbor. On June 21, 1979, Colonel Lockridge responded to the questions in a revised addendum to the harbor report. The Chief of Engineers' reservations about the report were satisfied and the report was sent to the Secretary of the Army on September 25, 1981.[31] The city of Memphis awaits congressional funding of the approximately $92.2 million project.

Recreation and Administration

Unlike many other engineer districts across the nation, Memphis District has not become deeply involved in recreational activities. That part of the lower Mississippi assigned to the Memphis District is mostly flat alluvial terrain, and does not easily lend itself to reservoir-type flood control structures that can be used for recreational activities. The one major exception is Lake Wappapello in the upper section of the St. Francis Basin.

The Overton Act of 1936 approved a comprehensive flood control plan for the St. Francis Basin. As part of the plan, Wappapello Dam was constructed to contain runoff from about 1,310 square miles above the dam. The dam created Lake Wappapello with a 625,000-acre-foot capacity that is released into a floodway below the dam in a systematic way.

Since its completion in 1941, Lake Wappapello has been a showcase for the Memphis District. In other parts of the District the Engineers have been criticized for lack of environmental concerns, but at Lake Wappapello many environmental projects have received awards. A 15-mile wildlife observation trail was constructed for the avid hikers, but for those not so ambitious there is a 1-mile trail with several overlooks.

In 1980 the Office, Chief of Engineers, honored Corps personnel at Lake Wappapello for their efforts to improve wildlife environment at the lake. The award was for a plan jointly sponsored by the Missouri Department of Conservation. Included in the plan were wildlife food plots on nearly 600 acres near the lake, and 150 nesting boxes for wood ducks at several locations. Also, nesting areas were built for several Canadian geese that were released in the area.[2] Each year Corps personnel sponsor activities at the lake that are family oriented. For instance, each year the Corps sponsors the Old Greenville Black Powder Shoot and conducts competitions in marksmanship and knife and tomahawk throwing. The lake has changed dramatically since its completion. Though it is still primarily a flood control structure, residents in the area see it as a recreational lake, and approximately 750,000 people visit the lake each year.

Another part of the St. Francis Basin Project includes recreational features. As part of the project the W. G. Huxtable Pumping Station was constructed approximately 13 miles upstream from the confluence of the St. Francis River and Mississippi River. Completed in 1977, the pumping station is a combination stormwater pumping station and floodgate which has a drainage area of 2,000 square miles.

An uncontrolled weir upstream from the station impounds water and creates a lake 20 feet deep at the weir. The lake extends approximately 30 miles upstream and was part of the fish and wildlife mitigation features of the project. In cooperation with the Arkansas Game and Fish Commission, the Corps of Engineers constructed picnic areas, parking facilities, and a boat launching ramp.[3]

In 1965 the Arkansas Game and Fish Commission and the U.S. Fish and Wildlife Service constructed three dams in an abandoned bendway of the Mississippi River near Osceola, Arkansas, to create Lake Neark. The Corps warned officials that the first high water would wash the dams away, and two of the three dams were destroyed in January 1966. On April 11, 1974, the House Committee on Public Works requested the District Engineer to determine the feasibility of a project to rebuild Lake Neark.[4]

The Memphis District Engineer, Colonel Lehman, decided that congressional authorization for the lake would take too long. He believed the lake could be constructed quicker

W. G. Huxtable Pumping Station on the St. Frances River.

under authority granted the Chief of Engineers in the Flood Control Act of 1944 to construct recreational facilities. The study for Lake Neark, completed in 1978, recommended constructing a dike at each end of the old bendway to create a 12-mile-long lake. The cost was estimated to be $786,000.

Because the construction of the dikes would cause less siltation in Osceola harbor and, consequently, less dredging of the harbor, a dispute over funding developed. The dispute resulted in a reevaluation of the project, and the Chief of Engineers decided that congressional approval was necessary prior to participation. A new study was initiated and completed in the summer of 1981. At a public meeting held in Osceola on August 18, 1981, the Corps presented a plan that was essentially the same as previous ones, but because of inflation, the costs had escalated to $1.3 million.[5] The Arkansas Game and Fish Commission supported the project over the years of study, but some members of the Commission began to have second thoughts about Lake Neark. One member of the Commission withdrew his support because he thought the dikes would not be high enough to provide an adequate supply of water for the lake. In April 1982, the Mayor of Osceola indicated that the project was dead without the support of the Arkansas Game and Fish Commission.[6]

The Memphis District initiated its second century of work on the Mississippi River on a note of controversy. In 1975 the Division Engineer, Major General Koisch, increased the District Engineer's authority for approval of plans and specifications for all construction to a funding limit of $1,000,000. In January 1976, much of the authority was removed by requiring District Engineers to submit detailed plans to the Division Engineer for approval. Colonel Lehman did not question the Division Engineer's overall responsibility for the Mississippi River and Tributaries Project, but did protest staff review and approval of every minute detail. Because of the review of almost every construction project, the bank protection parties had to change over 35 percent of the final layout of the graded bank and almost every layout of articulated concrete mattress during the 1975 revetment season.[7]

In addition to the dispute with Division headquarters, Colonel Lehman had a problem with the funding of small projects in the District. The small project programs are funded under authority of several flood control laws dating back to 1946. The projects are usually funded by general appropriations. Faced with major deficits in early 1976, the acting Director of Civil Works, Brigadier General Kenneth E. McIntyre, suspended funding for the programs. All new starts for small projects were suspended and all available funds were to be expended on completing projects already under way. No reconnaissance reports or detailed project reports were to be started until new funding became available. More than 18 projects were affected by the funding squeeze. Later in the year the funding freeze was thawed.

Colonel Lockridge inherited a District with a payroll of more than $23.3 million. Within the District there were 771 permanent employees, 646 temporary employees, and two trainees.[8] One of the major problems faced by Colonel Lockridge was to improve the planning functions of Memphis District. Time after time the District had failed to meet milestones set at the beginning of a project. The delays were caused by many things, including project reevaluation, law suits, program reviews, work load of employees, new regulations, and the many levels of review. Nevertheless, the District Engineer intended to increase performance by shifting 37 employees to planning activities, but the move was only partially successful.

Colonel Lockridge was replaced as District Engineer by Colonel William H. Reno in June 1979.[9] Colonel Reno faced many of the same problems of delay in getting studies completed and construction under way. In 1981 the Memphis District had more than $50 million in projects under construction, or ready for construction, but the District was 50 employees short of its total authorization of 680 full-time employees.[10]

In August 1981, Colonel John F. Hatch replaced Colonel Reno as District Engineer. Colonel Hatch was faced with further cutbacks of personnel ordered by the Reagan Administration. In September 1981, the Division Engineer ordered a reduction of 50 employees for the Memphis District as part of a program to reduce the workforce along the Mississippi by 392 jobs by October 1, 1982.[11] The cuts prompted the combination of the construction and operations divisions.

Part of the manpower reduction will lead to a transfer of some responsibilities in the Memphis District. The west bank levee of the Mississippi River from Commerce to Birds Point in Missouri will be transferred to the St. Louis District. The Memphis District will retain responsibility for the operation of New Madrid Floodway. Also, the administration of Lake Wappapello and the St. Francis Basin-Little River Diversion project will be transferred to St. Louis District.[12]

Budget reductions planned for the next few years will result in the Memphis District reducing its civil works program. According to Colonel Hatch, anticipated cutbacks will eliminate dredging for all Corps managed harbors in the District, including Memphis.[13]

The Corps of Engineers started its second century of work on the Mississippi in the Memphis vicinity in 1976. The first 6 years of the new center of work was relatively quiet. Many of the old environmental controversies that plagued the District have been resolved or are in the process of being resolved. Memphis District realizes that it has a responsibility for balancing the economic and environmental benefits of its numerous projects. The reduction in funding and the transfer of responsibilities to other Districts will result in a smaller visible role for the Memphis District, but the District will adjust to priorities set by higher authorities.

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